

MOSS FLORA

OF

NORTH AMERICA

North of Mexico

BY

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BARTRAMIACEAE

BY

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TIMIACEAE and AULACOMNIACEAE

BY

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BRYACEAE (I)

BY

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1. AMPHIDIUM LAPPONICUM (Hedw.) Schimp. Bry. Eur. Coroll. 39. 1855. Type species.

Anictangium lapponicum Hedw. Sp. Musc. 40. 1801.*Anictangium striatum* Brid. Sp. Musc. 1: 25. 1806.*Zygodon lapponicus* Bry. Eur. fasc. 4. pl. 206. 1838.*Amphoridium lapponicum* Schimp. Syn. (Ed. 1) 247. 1860.

Plants caespitose, dark green, brown to blackish below, 1–3 cm. high; leaves more or less crisped when dry, spreading when moist, narrowly oblong-lanceolate to linear-lanceolate, sharply to obtusely acute at apex, 1.5–2 mm. long; margin plane, entire; costa strong, ending shortly below apex, with 4 median guide cells; lamina mostly of one layer of cells; upper median cells roundish-quadrate, incrassate, 8–10 μ in diameter, papillose both sides with numerous low papillae; basal cells smooth, larger, rectangular, *thinner-walled, pellucid to hyaline; perichaetial leaves very different, sheathing, entirely smooth, with upper cells elongated, rhomboidal to rhombic*, the upper more abruptly acuminate and often serrate at base of acumination. Autoicous; seta about 1.5 mm. long; capsules pyriform, with a distinct neck as long as the spore sac, about $\frac{1}{2}$ emergent, erect and symmetric, brownish and 8-ribbed when dry, more or less urceolate with a spreading mouth; operculum red, *with beak usually less than the radius of the capsule*; calyptra covering about $\frac{1}{2}$ the capsule; spores 10–12 μ , mature in spring or early summer. Type locality, Lapland.

ILLUSTRATIONS:—Bry. Eur. l. c.; M. H. M. 175. f. 82; Braithw. Brit. Moss. Fl. 2: pl. 53E; Limpr. Laubm. 2: f. 212; Pl. 59B.

EXSICCATI:—Drumm. Musc. Am. 28 (as *Gymnostomum*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 115, (Ed. 2) 171; Aust. Musc. Appal. 154; Holz. Musc. Acro. Bor. Am. 239, & 451, also 63 (as *A. Mougeotii*); Bart-ram, Mosses So. Arizona 166; Allen, Mosses Cascade Mts. 36; Grout, Musci Perfecti 111.

Growing in crevices of moist shaded ledges and cliffs in cool elevated regions, rarely on rocks containing lime; Greenland to British Columbia, south to California and the northern U. S. east of the Rockies.

Var. CRISPATUM (Kindb.) n. comb.

Zygodon crispatus Kindb. Rev. Bryol. 23: 21. 1896.

Plants slender, light colored, with appearance of *A. Mougeotii*; leaves more distant, with bases more sheathing and very sharply acute ("acicular") apices. Type on rocks near Revelstoke, B. C., May 9, 1890 (Macoun). A specimen bearing this label has been studied. The leaf margins are less recurved and the cell structure is that of *A. lapponicum*.

A specimen from the Rocky Mountains, Laggan, Alberta, June 27, 1904, coll. Macoun, det. Kindb., Can. Mosses 105, at the New York Botanical Garden, has linear-lanceolate leaves, narrower than usual and perichaetial leaves broad, sheathing up to the base of the capsule.

2. AMPHIDIUM MOUGEOTII (Bry. Eur.) Schimp. l. c.

Zygodon Mougeotii Bry. Eur. l. c.*Amphoridium Mougeotii* Schimp. Syn. l. c. 248.*Zygodon decipiens* Kindb. Eur. & N. Am. Bryin. 317. 1897.

Plants in dense tufts, yellowish-green above; stems more slender than in *A. lapponicum*, 2–6 cm. high (occasionally reaching 10 cm.), dichotomously branching; leaves more distant, *narrowly linear-lanceolate, reaching 3 mm. in length*, spreading to erect-spreading, somewhat crisped when dry, gradually and slenderly acuminate; *margins entire, in most cases recurved on one or both sides from about the middle of the leaf to the subsheathing base*; costa strong, ending near the leaf apex, with 2–4 guide cells; upper median leaf cells less regular and more incrassate than in the preceding species, mostly rounded-quadrate with papillae less distinct; basal cells smaller, more incrassate and colored; *perichaetial leaves much less strongly differentiated, sheathing only at base, scarcely different from stem leaves* except that the apical cells are more elongated, elongated median and basal cells very incrassate. Dioicous; capsule barely exserted on a seta 2–3 mm. long, short-pyriform, when dry 8-ribbed, *little or not at all contracted under the mouth when dry, subcampanulate; operculum with beak equal to the radius of the capsule*; spores in summer or late autumn. Type locality, Vosges Mts.

ILLUSTRATIONS:—Bry. Eur. l. c.; Braithw. l. c. pl. 53F; Pl. 58C & 59A.

EXSICCATI:—Macoun, Can. Musci (420) 305; Aust. Musc. Appal. 155; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 170; R. & C. Musc. Am. Sept. 174.

On damp shaded rocks, usually non-calcareous, in cool elevated regions; Newfoundland to Alaska, south to Alabama and Oregon. Rare and seldom fruiting.

Amphidium decipiens from "On rocks, Agassiz, British Columbia, May 15, 1889," apparently the type collection, is nothing but *A. Mougeotii*. The costa is not "long excurrent."

3. AMPHIDIUM CALIFORNICUM (Hampe) Broth. Engler and Prantl (Ed. 1) Teil I. 3¹: 460. 1909.

Zygodon californicus Hampe, Bot. Zeit. 20: 361. 1862.

Amphoridium californicum Jaeger & Sauerb. St. Gall. Nat. Gesell. 1872-1873: 385.

Didymodon caespitosus Mitt. Journ. Linn. Soc. 8: 18. 1865.

Amphoridium caespitosum Jaeger & Sauerb. l. c. and Lesq. & James, Manual, 160. 1884.

Plants reaching 3-4 cm. high, slender, often much branched above; leaves long linear-lanceolate, crisped when dry, erect-spreading from a subsheathing base when moist, 3-4 mm. long, slenderly acuminate, canaliculate-carinate, margins (in most leaves) irregular in outline to *distantly toothed, more or less recurved* near the base on one side at least; costa strong, vanishing in the apex; upper leaf cells rounded-quadrate, incrassate, about 9 μ in diameter, with very low inconspicuous papillae, gradually changing to the smooth, more elongated and more translucent rectangular basal cells, which are thinner-walled and *more* elongated at the margins near the insertion. Dioicous; antheridial plants intermixed with the archegonial; perichaetial leaves sheathing in the lower $\frac{1}{2}$ only, not much differentiated, longer than the capsule and seta; capsule ovoid-pyriform, neck shorter than in the preceding species, often inclined by the curving of the seta, 8-ribbed when dry and contracted below the mouth, which is scarcely narrowed in drying, urn about 1 mm. long; *operculum conic-apiculate*; spores rarely produced. Type from San José Valley, California. Bauer.

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. pl. 32; Pl. 58.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 240 & 626, also 342 (as *A. caespitosum*); Macoun, Can. Musci 307 (as *A. caespitosum*), his 306 in my set is *A. Mougeotii*; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 172.

The serration and recurving of the margins is exceedingly variable; on some leaves of some specimens the margins may be plane and entire, while other leaves are characteristic.

On shaded rocks, southern California to Vancouver Island; rare. Macoun, Can. Musci 307a from Cape Breton, Nova Scotia, Jan. 4, 1898, issued as *Zygodon Sullivantii* Lesq. & James, cannot be distinguished from this species.

4. *ZYGODON Hook. & Tayl. Musc. Brit. 70. 1818.

Plants dark green to blackish; stems tomentose, slender, erect to ascending, dichotomously branching; leaves *oblong-lanceolate to linear-lanceolate*, usually twisted when dry, acute, with mostly plane margins; costa strong, ending below the apex to shortly excurrent; upper leaf cells small, rounded and incrassate; perichaetial leaves scarcely different; capsules emergent to exserted, *8-ribbed*, with a distinct neck, erect and symmetric, pyriform or cylindric; peristome single or double or lacking; *calyptra cucullate, smooth*. Closely allied to *Orthotrichum* and *Ulotia*; stems often more slender, leaves usually more slender and bearing brood bodies in most species. The smooth, small, cucullate calyptra is the most distinctive character when present. Type species *Z. conoideus*.

KEY.

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|---|-----------------------------|
| 1. Leaves serrate; plants growing on rocks..... | 3. <i>gracilis</i> . |
| Leaves entire..... | 2. |
| 2. Brood bodies clavate, 3-5 celled; peristome lacking..... | 3. |
| Brood bodies mostly fusiform, 5-7 celled; peristome double..... | 2. <i>conoideus</i> . |
| 3. Leaves lanceolate; plants growing on trees..... | 1. <i>viridissimus</i> . |
| Leaves ligulate-lanceolate; plants growing on rocks..... | 1a. var. <i>rupestris</i> . |

1. ZYGODON VIRIDISSIMUS (Dicks.) Brown, Trans. Linn. Soc. 12¹: 575. 1819.

Bryum viridissimum Dicks. Pl. Crypt. fasc. 4: 9. pl. 10, f. 18. 1801.

Zygodon rufo-tomentosus E. G. Britt. nomen nudum; Paris, Index, (Ed. 2) 5: 141. 1906.

Plants in small bright pale green tufts or cushions 1-2 cm. high; stems erect or ascending, tomentose with more or less papillose radicles, which often bear 4-5-celled clavate brood bodies; leaves close, somewhat twisted and contorted when dry, spreading and recurved when moist, linear-lanceolate to oblong-

* See Mrs. Britton's articles in The Bryologist 11: 61-65. pl. 6.

lanceolate, 1-2 mm. long, acuminate and often subulate at apex and ending in one or two single elongated cells, carinate; margins plane and entire; costa vanishing below the apex; upper median leaf cells rounded, thick-walled, papillose both sides, 8-11 μ in diameter; basal short-rectangular, rounded at the angles, incrassate, smooth; small clavate jointed brood bodies of 3-5 cells are often found on the leaves and in the axils; inner perichaetial leaves smaller, with basal cells nearly linear. Dioicous; seta 3-7 mm. long, terminal, becoming lateral by innovations; capsule elongated-pyriform, 1.5-2 mm. long, 8-ribbed when dry and empty, contracted at the mouth; operculum obliquely rostrate; annulus and peristome lacking; calyptra fugacious; spores rough, 13-16 μ , mature in summer. Type locality, England.

ILLUSTRATIONS:—Bry. Eur. *pl.* 206; Mem. Torr. Bot. Club 4: *pl.* 80; Braithw. Brit. Moss Fl. 2: *pl.* 54C; Bryol. 11: *pl.* 6. 1908. *Pl.* 58 & 59.

On trees, mountains of northern New York and Virginia, south to North Carolina and Georgia; Washington, Arizona; rare and subalpine.

1a. Var. RUPESTRIS Hartm. Skand. Fl. (Ed. 9) 52. 1864.

Zygodon rupestris Lindb. Milde, Bryol. Siles. 164. 1869.

A rock-inhabiting form of the West Coast; plants more robust; leaves longer on the average and relatively narrower, with subulate apex rather longer and more slender; elongated basal cells longer and more numerous. Type locality, Scandinavia.

EXSICCATI:—Drumm. Musc. Am. 27; Allen, Mosses Cascade Mts. 46; Macoun, Can. Musci 303, from Vancouver Id. May 17, 1893.

On calcareous rocks; Hudson Bay; Vancouver Id, and Cascade Mts.; Alaska.

The leaves are sometimes recurved when moist, authorities to the contrary notwithstanding.

2. ZYGODON CONOIDEUS (Dicks.) Hook. & Tayl. Musc. Brit. 71. *pl.* 21., excl. synonyms. 1818.

Bryum conoideum Dicks. Pl. Crypt. fasc. 4: 9. *pl.* 11, f. 2. 1801.

In many particulars resembling *Z. viridissimus*, leaves with the same subulate apex, but relatively broader, closely appressed and little contorted when dry, scarcely recurved when moist; leaf cells larger, reaching 15 μ but mixed with much smaller ones; brood bodies mostly fusiform, 5-7 celled. Seta about 7 mm. long; capsule pyriform with neck nearly as long as the urn; *peristome double*, fugacious, the 16 outer teeth united in pairs, about 0.1 mm. long; segments 8, linear, delicate, shorter than the teeth. Type locality probably British.

ILLUSTRATIONS:—Bry. Eur. *pl.* 206 (as *Z. Brebissoni*); Braithw. Brit. Moss Fl. 2: *pl.* 54D; Dixon & Jam. Handb. Brit. Mosses (Ed. 3) *pl.* 311; *Pl.* 59.

On bark of tree, Sheet Harbor, Nova Scotia, no. 456, also at Kedji, no. 533 (Margaret S. Brown); near John's Beach, Newfoundland, Waghorne.

3. ZYGODON GRACILIS Wils. Musc. Brit. exs. no. 200. 1862; Berk. Handb. Brit. Mosses 219. 1863.

Plants in wide dense dark green tufts or cushions, brown to blackish below, 2-7 cm. high, repeatedly branching, stout and suberect, or pendent and slender; leaves normally crowded, appressed and contorted when dry, spreading-recurved when moist, lanceolate, 1.5-2 mm. long, carinate, decurrent; margins mostly plane, entire below, *coarsely and sharply serrate above*; costa strong, ending below the broadly acute apex, papillose on the back above; leaf cells in upper leaf rounded-quadrate to rounded-hexagonal, reaching 10 μ in diameter, *pluripapillate*, incrassate; basal cells rectangular, smooth, shorter at the margin; perichaetial leaves not differentiated. Dioicous; seta reddish, about 3 times the length of the oblong-cylindric capsule, which is slightly inclined, 8-ribbed when dry and empty; peristome double, resembling that of *Z. conoideus*; spores 12-14 μ , smooth, mature in August. Type locality, Yorkshire, England. Typical form not yet found in N. America.

ILLUSTRATIONS:—Braithw. l. c. *pl.* 54F; Dixon & James. l. c. *pl.* 32B; Limpr. Laubm. 2: f. 214.

3a. Var. AMERICANUS n. var.

Folia oblonga, 1 mm. longa, margine revoluta ad medium, superne cellulis quadratis vel hexagonis, minus incrassatis, 12-15 μ .

Leaves oblong, scarcely tapering until near apex, about 1 mm. long with margins often recurved in the middle; leaf cells less incrassate, 12–15 μ in diameter, quadrate to hexagonal, collenchymatous. Type locality, on face of cliff, summit of Chestnut Bald, North Carolina, alt. 6000 ft. (Grout, Aug. 4, 1907). Type in herb. A. J. G. & N. Y. Bot. Garden. *Pl.* 62.

Leptodontium excelsum (Sull.) E. G. B. (*Amphoridium Sullivantii* of the Lesq. & James Manual) will most certainly be sought here, where its habit and habitat seem to place it, but I yield to the judgment of two such eminent authorities as Brotherus and Mrs. Britton. It has the leaf margins revolute in the lower $\frac{1}{2}$ and serrate to the middle or below.

5. DRUMMONDIA Hook. in Drumm. Musc. Am. no. 62. 1841.

We have but one species. Brotherus lists 7 from the whole world.

DRUMMONDIA PROREPENS (Hedw.) Jennings, Mosses W. Pa. 116. *pl.* 14. 1913.

Gymnostomum prorepens Hedw. Sp. Musc. 35. *pl.* 3. 1801.

Drummondia clavellata Hook. l. c.

Plants in thin dense mats, dark green to almost black below; primary stems long, reaching 10 cm. or more in length, sending up numerous short (2–10 mm.), crowded, densely foliate branches; leaves closely appressed when dry, erect-spreading when moist, oblong- to ovate-lanceolate, acute to narrowly obtuse, 1–2 mm. long, concave, carinate, firm; margins plane or widely inrolled, entire; costa strong, almost percurrent; upper leaf cells small, lumen 7–10 mm. in diameter, rounded, incrassate; basal scarcely different except at the very insertion, where they are often larger and more translucent; in the perichaetial leaves a considerable area of basal cells is elongated, becoming rectangular near the insertion. Dioicous, archegonia and antheridia in terminal buds; seta erect, 2–3 mm. long; capsule erect and symmetric, ovoid-globose, about 1–1.3 mm. long; operculum conic-rostrate with a long oblique beak; mouth of the capsule bordered by several rows of small thick-walled cells; exothelial cells parenchymatous, thin-walled, irregular, oblong to hexagonal; stomata apparently lacking; peristome of 16 short (about 60 μ) teeth, truncate and smooth, persistent; inner peristome and annulus lacking; calyptra large, conic, cucullate, without hairs; spores 60–90 μ , mature in spring. Type locality, Pennsylvania (Muhlenberg). This is the type species.

ILLUSTRATIONS:—Hedw. l. c.; Jennings, l. c.; Sull. *Icones Musc.* *pl.* 33; M. H. M. f. 83; *Pl.* 60.

EXSICCATI:—Drumm l. c.; Sull. Musc. Allegh. 130; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 129, (Ed. 2) 140; Aust. Musc. Appal. 152; Small, Mosses So. U. S. 7.

On bark of trees, mostly in woods; New England to Ontario, south to Georgia, Alabama and Missouri; frequent in elevated regions in the N. E. U. S.

The spores often appear multicellular as if cell division started before the spores are shed.

On trees, Pelee Island in Lake Erie, June 16, 1882, Macoun collected monoicous plants which Kindberg called var. *canadensis* (Macoun, Cat. Can. Pl. 6: 81. 1892).

✓ 6. SCHLOTHEIMIA Brid. Musc. Recent. Suppl. 2: 16. 1812.

Plants robust to slender, growing in rather dense and (in our species) rather thin mats, dark green to almost black; primary stems long and creeping, with numerous erect or ascending branches which are densely foliate and usually densely radiculose, especially near the base; leaves erect-spreading to subsquarrose, closely and often spirally appressed when dry, mostly lingulate or lanceolate, entire and without border; costa strong, mostly percurrent to excurrent, with ventral guides; leaf cells small, incrassate; capsules exserted, erect and symmetric, ovoid to cylindric, smooth to somewhat ribbed; peristome double, the teeth reflexed when dry, linear-lanceolate, papillose, reddish; segments shorter, sometimes rudimentary; calyptra campanulate, never plicate, usually smooth, sometimes rough at apex, usually covering most of the capsule. Type species, *S. torquata* (Hedw.) Brid.

KEY.

- Leaves mostly lingulate and mucronate, strongly undulate-rugose above 1. *Sullivantii*.
Leaves lanceolate, acuminate, not undulate or plicate 2. *lanceifolia*.

1. SCHLOTHEIMIA SULLIVANTII C. Muell. Syn. 1: 756. 1849.

Schlotheimia rugifolia Hook & Wils. in Drumm. Musc. Am. S. States 85. 1841. (not of Hooker, 1818–1820).

Plants in wide thin mats, dark green, at times almost black, lighter at the growing tips; primary stems creeping, 3–5 cm. long, closely branching; branches 2–5 mm. high, erect or nearly so, densely foliate, the

whole mat more or less interwoven with numerous brown papillose radicles; leaves crowded, erect-spreading to somewhat recurved when moist, when dry somewhat spirally twisted at the apex of the branches, 1.4–2 mm. long, lingulate, mucronate at the rounded apex, undulate-rugose in the upper part, more or less longitudinally plicate below; costa strong, usually excurrent into the mucro; upper leaf cells rounded-elliptic to subcircular, with very thick walls, and lumen about 6–8 μ in diameter, smooth, gradually elongated to the basal; basal linear, in old leaves with lumen little wider than the thickness of the cell walls. Monoicous; antheridial buds lateral; seta 2–4 mm. long; calyptra covering the whole capsule, lobed and incurved at base, scabrous at apex; capsules oblong-cylindric, gradually narrowed upwards, 2 mm. or more in length, somewhat shrivelled when dry; annulus lacking; operculum conic, long-rostrate; occasionally some leaves will be acute rather than apiculate; mouth of capsule bordered by several rows of short rounded cells, exothelial cells rectangular to linear, very incrassate; peristome teeth 16, inserted below the capsule mouth, linear, articulate, with a lighter median line, red-brown, finely papillose; segments shorter and narrower, papillose, 16; spores of many sizes, 15–35 μ , maturing in winter. Type locality, Louisiana.

ILLUSTRATIONS:—Sull. Icones. Musc. *pl.* 38; *Pl.* 61.

EXSICCATI:—Drumm. l. c.; Sull. Musc. Allegh. 146; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 127, (Ed. 2) 192. Holz. Musc. Acro. Bor. Am. 161; Grout, Musci Perfecti, 226; Small, Mosses So. U. S. 23; Aust. Musc. Appal. Suppl. 499; R. & C. Musc. Am. Sept. 40, 40b.

Bark of trees; Gulf States, north to N. Carolina, Tennessee and Virginia.

2. SCHLOTHEIMIA LANCIFOLIA Bartram, Bryol. 35: 9. *pl.* 3. 1932.

Growing in wide dense mats, dark brown except at the growing tips, size and habit much as in the preceding; leaves of primary stems erect, appressed when dry, narrowly lanceolate, acuminate, 1.5 mm. long; branch leaves larger, more crowded, erect-spreading when moist, spirally twisted around the stem, with spreading flexuose points when dry, *oblong-lanceolate, acuminate*, reaching 2.5 mm. in length by 0.6 mm. wide, carinate, *neither plicate nor undulate*; margin narrowly reflexed on one side near the base, otherwise plane, entire or minutely crenulate in the upper half; costa brownish, 35 μ wide near the base, prominently rounded on the back, ending just below the apex; upper leaf cells smooth, rounded, incrassate, 7–9 μ in diameter near the costa, smaller near the margin, gradually elongating below to the rectangular, somewhat sinuose basal cells; perichaetial leaves scarcely differentiated. Autoicous; seta reddish, smooth, 6 mm. long; capsule erect and symmetric, ovoid-cylindric, urn 2 x 0.8 mm.; operculum not seen; calyptra campanulate, deeply 4–6 lobed at base, nearly smooth at apex; peristome teeth reddish brown, fleshy, recurved when dry; segments pale yellow, slightly shorter than the teeth, coarsely papillose-striate; spores rounded, irregular in size, papillose. Type from "Bark of tree, Ravenel's Forest, Highlands, N. Carolina, alt. 4,000 ft., July 26, 1930" (Sharp no. 151). *Pl.* 61A.

7. MACROMITRIUM Brid. Musc. Recent. Suppl. 4: 132. 1819.

Robust to very slender plants, closely resembling *Drummondia* and *Schlotheimia* in habit and appearance; leaves erect to squarrose-spreading when moist, appressed and rigid to crispate or spirally twisted when dry, lanceolate to oblong-lanceolate and obtuse, acute or acuminate, sometimes linear or oblong-lingulate; costa strong, ending in or below the apex in our species; upper leaf cells small, rounded and mostly incrassate, smooth to papillose, basal elongated in most species; perichaetial leaves little differentiated. Dioicous or autoicous; capsules mostly exserted on a fairly long seta, subglobose to oblong-ovoid; peristome inserted below the mouth, double or single, sometimes lacking. Type species, *M. aciculare* (Brid.) Brid.

Key.

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|--|---------------------------|
| 1. Leaves crispate when dry, strongly papillose; calyptra slightly hairy..... | 2. <i>rhabdocarpum</i> . |
| Leaves somewhat contorted or twisted, scarcely crispate when dry, only slightly papillose or mammillose..... | 2. |
| 2. Leaves mostly lingulate and mucronate; calyptra smooth..... | 1. <i>mucronifolium</i> . |
| Leaves lanceolate and acute; calyptra hairy..... | 3. <i>Sullivantii</i> . |

1. MACROMITRIUM MUCRONIFOLIUM Hook. & Grev. Edinb. Journ. Sci. 1: 116. *pl.* 4. 1824.

Macromitrium brevipes C. Muell. Syn. 1: 728. 1849.

Plants in wide dense mats, dark green, almost black except at the young tips; primary stems creeping, with numerous short (3–5 mm.) branches; leaves crowded, strongly spirally twisted around the stem when

dry, widely spreading when moist, concave, lingulate and apiculate (rarely a few of the leaves oblong-lanceolate and acute) 1-1.5 mm. long, more or less plicate longitudinally, but not undulate or transversely wrinkled above; margins plane and entire; costa strong, extending into the mucro or ending just below it; upper leaf cells rounded-hexagonal or irregular, incrassate, more or less mammillose or bulging, 7-9 μ in diameter, the marginal smaller; at basal margins a few narrowly linear cells, *in the main portion of the base only a few cells at the insertion noticeably elongated and colored*. Autoicous; calyptra narrowly conical, covering the capsule to the base, smooth; seta 3-5 mm. long, smooth; capsule obovoid, whitish when old; urn about 1.5 x 1 mm., smooth or slightly wrinkled at base when dry and empty, but not contracted below the mouth; peristome lacking or represented by an inconspicuous low membrane; exothelial cells thin-walled, short-rectangular to oblong-hexagonal, with a few rows of small rounded, dark colored cells around the mouth; stomata in the narrow neck; spores in summer. Type locality, W. Indies.

ILLUSTRATIONS:—Pl. 62.

On bark of broad-leaved shrubs and trees, especially the upper side of horizontal limbs; not rare in peninsular Florida.

The description in the Lesq. & James Manual is very misleading. It resembles *Schlotheimia Sullivanii* but is easily distinguished by the short capsules and non-rugose leaves.

2. MACROMITRIUM RHADBOCARPUM Mitt. Journ. Linn. Soc. 12: 199. 1869.

Plants in wide thin mats, yellowish green above, dark reddish brown below; primary stems creeping, reaching several centimeters in length, sending up numerous short (up to 1 cm.) densely foliate branches, which are often branched above; *leaves strongly crisped*, erect-open when moist, oblong-lanceolate, acute to obtuse and apiculate, reaching 1.6 mm. in length, carinate; margins entire, plane or somewhat revolute; upper leaf cells rounded oval to subcircular, incrassate, 7-12 μ in diameter, *strongly papillose on both sides*, gradually changing to the smooth elongated, oblong to linear basal cells, with walls often thicker than the lumen; costa strong, ending just below the apex to shortly excurrent into the apiculus; perichaetial leaves larger, reaching 2 mm., more slenderly acute, smooth throughout, upper cells more or less elongated and margins more strongly revolute. Monoicous; calyptra with very few and inconspicuous hairs, plicate, covering the entire capsule; seta straight, smooth and erect, 6-10 mm. long; capsule oblong-ovoid to oblong-cylindric, erect and symmetric, gradually narrowed at both ends, striate at base when dry and empty, 1.25-1.5 mm. long; operculum subulate; peristome single, the teeth short pale and fragile, deeply inserted; spores rough, 13-18 μ . Type locality, Andes Quitenses, Spruce 199. Pl. 62.

On bark of trees and shrubs; several localities in Florida, also in Ecuador. Mitten says the capsule is plicate its whole length "even into the seta."

3. MACROMITRIUM SULLIVANTII C. Muell. Bot. Zeit. 20: 361. 1862.

Macromitrium Dregei Sull. Mosses U. S. 31. 1856 (not of Hornsch. 1841).

Macromitrium Fitzgeraldi Lesq. & James, Manual 178. 1884?

Plants in rather thin dense, dark green mats, reddish brown below; primary stems creeping, 5-7 cm. long, sending up numerous slender, suberect, densely foliate, subulaceous branches 1-2 cm. long; branch leaves closely imbricate when dry, erect-spreading when moist, lanceolate to narrowly triangular-lanceolate, narrowed to the insertion, about 1 mm. long, gradually acuminate, narrowly acute to narrowly obtuse at apex, carinate, somewhat excavate at base as in *Uloa*; margins plane or slightly recurved below, entire or mammillose-crenulate at base; costa strong, extending to near the apex; upper leaf cells about 7 μ in diameter, rounded, incrassate, slightly bulging, slightly smaller on the margins; lower cells near the base a little larger, more translucent, often strongly mammillose. Monoicous, antheridial buds axillary or terminal, perigonal leaves ovate, erose-serrulate above; calyptra hairy, covering the whole capsule; seta erect, smooth, 5-8 mm. long; capsule exserted, oblong-cylindric, about 3 mm. long, somewhat plicate at mouth and base when dry; operculum conic-subulate; peristome consisting only of a narrow inconspicuous membrane representing the inner peristome. Type locality, on bark of old pine trees, Jonah or Bear Mountain, Georgia (Lesquereux).

ILLUSTRATIONS:—Sull. Icones Musc. pl. 37; Pl. 60.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 128, from which the description is drawn. Not since collected; issued as 193 in (Ed. 2).

Dr. Farlow wrote Mrs. Britton that there was no specimen marked *M. Fitzgeraldi* in the James Herbarium at Harvard and R. S. Williams believes it to be a synonym of *M. Sullivanii*.

KEY TO THE GENERA OF THE ORTHOTRICHACEAE.

1. Primary stems long and creeping, sending up numerous short densely foliate branches; plants almost pleurocarpous in habit..... 8. *Macromitrieae*.
Creeping stems (with few exceptions) short or lacking..... 2.
2. Leaves plainly crispate when dry..... 3.
Leaves not crispate, sometimes somewhat contorted or twisted when dry..... 6.
3. Stomata immersed; basal-marginal leaf cells scarcely differentiated.
Pulchella group of 1. *Orthotrichum*.
Stomata superficial; basal-marginal leaf cells mostly differentiated, either wider or narrower..... 4.
4. Perichaetial leaves plainly different (except *A. californicum*)..... 3. *Amphidium*.
Perichaetial leaves not materially different..... 5.
5. Calyptra hairy..... 2. *Ulota*.
Calyptra not hairy in our species..... 4. *Zygodon*.
6. Calyptra cucullate, not plicate or hairy; stomata superficial..... 4. *Zygodon*.
Calyptra mitrate, conic-campanulate, often plicate or hairy, or both..... 7.
7. Basal-marginal leaf cells shorter and more nearly hyaline; stomata superficial..... 2. *Ulota*.
Basal-marginal leaf cells not markedly different; stomata superficial or immersed.. 1. *Orthotrichum*.
8. Calyptra hairy (or smooth), plicate, covering the whole capsule; peristome lacking or rudimentary..... 7. *Macromitrium*.
Calyptra not hairy, sometimes scabrous above, the peristomes various..... 9.
9. Capsules much longer than broad, 2 : 1 or more; peristome double..... 6. *Schlotheimia*.
Capsules not over 1.5 : 1; peristome single, of 16 short truncate teeth..... 5. *Drummondia*.

TIMMIACEAE.*

BY GENEVA SAYRE.

Plants large, tufted; leaves lance-linear, sheathing, costate, toothed at least above; leaf cells often papillose, in the blade small, \pm isodiametric, in the sheath elongate. Autoicous or dioicous; capsule sub-erect to pendent, ovoid to elongate; calyptra at maturity standing erect from the seta behind the capsule, frequently sliding down the seta, or deciduous; annulus present; peristome double, the outer row of 16 teeth which bend inward from the middle after the operculum is shed, the inner a high basal membrane bearing 64 partially united cilia.

One genus:

TIMMIA Hedw. Sp. Musc. 176. 1801.

Mnium (in part) P. Beauv. Prodr. 74. 1805.

Orthopyxis (in part) P. Beauv. Prodr. 79. 1805.

Plants green above, brown and somewhat radiculose below, sparingly branched; central strand distinct; leaves lance-linear, sometimes blunt, sheathing, spreading when wet, canaliculate; margins plane, strongly toothed in the upper $\frac{1}{3}$ with broad teeth usually composed of several cells, teeth smaller or absent toward the base; upper leaves usually longer than those below; costa stout, forming a ridge on the back of the leaf, reaching to the apex or ending a few cells below; cells mostly convex on the ventral side and often papillose on the dorsal side; cells of the blade small, rounded, hexagonal or subquadrate, those in the sheath elongate and thin-walled; guide cells usually in a single row, a layer of small flat cells sometimes extending from the costa into the lamina, making the leaf bistratose at that point. Autoicous or dioicous, antheridia stalked, paraphyses unbranched; capsule suberect, horizontal or inclined, usually pendant when wet, neck more or less tapering when dry; stomata large; calyptra cucullate, or split at the middle and entire below, longer than the capsule; operculum hemispheric and apiculate to conic; annulus 2- or 3-seriate; outer peristome yellowish and lightly papillose in the lower half, longitudinally striate, more coarsely papillose and sometimes

* Contributions from the Department of Botany and The Rocky Mountain Herbarium, University of Wyoming, No. 156.

perforate in the upper half; membrane of the inner peristome reaching nearly the middle of the outer teeth, the 64 papillose cilia mostly remaining attached in twos and fours; spores brown, papillose to smooth.

Type species, *T. megapolitana*.

Named for Joachim Christian Timm, botanist and Burgermeister of Malchin, Mecklenberg, Germany.

On earth and earth-filled crevices of rocks and the bases of trees. Greenland, Canada, northern United States, extending down the Rocky Mountains and the Pacific Slope; scattered collections in the south-eastern states.

KEY.

- | | |
|---|----------------------------|
| 1. Cells in the leaf sheath of 2 kinds, those above red, those below hyaline, fragile; costa papillose on the back below. | 4. <i>norvegica</i> . |
| Sheath cells \pm uniform; costa not papillose on the back below. | 2. |
| 2. Cilia with conspicuous appendages; leaf bases hyaline or yellow; costa not toothed. Autoicous. | 3. |
| Cilia without appendages but with large joints; leaf bases usually orange; costa often toothed on the back above. Dioicous. | 5. |
| 3. Leaf cells smaller (6-9 μ), angular, mostly quadrate. Western. | 2. <i>bavarica</i> . |
| Leaf cells larger (10-14 μ), rounded and somewhat collenchymatous. | 4. |
| 4. Leaves narrowed gradually to the apex; sheath broader than the rest of the leaf; mouth of the capsule not flaring. | 1. <i>megapolitana</i> . |
| Leaves narrowed suddenly to the apex; sheath scarcely broader than the rest of the leaf; mouth of the capsule flaring. | 1a. f. <i>cucullata</i> . |
| 5. Leaves almost spatulate; sheath pale, scarcely broader than the rest of the leaf. Greenland. | 3c. f. <i>arctica</i> . |
| Leaves lanceolate; sheath orange, broader than the rest of the leaf. | 6. |
| 6. Leaves 4-6 mm. long. | 3a. f. <i>brevifolia</i> . |
| Leaves 6-8 mm. long. | 7. |
| 7. Plants about 16 cm. high. | 3b. f. <i>elongata</i> . |
| Plants under 10 cm. high. | 3. <i>austriaca</i> . |

1. TIMMIA MEGAPOLITANA Hedw. Sp. Musc. 176. 1801.

T. polytrichoides Brid. Musc. Recent. 2^o: 153. 1803 (in part?).

Orthopyxis megapolitana P. Beauv. Prodr. 79. 1805.

T. polytrichoides var. *viridis* Brid. Sp. Musc. 3: 99. 1817 (in part).

T. viridis Brid. Bryol. Univ. 2: 70. 1827.

Plants 3-5 cm. tall, stems brown; leaves crisped when dry, 5-10 mm. long, 1-1.5 mm. wide, gradually narrowed to the apex; sheath about 1/6 the length of the leaf, hyaline or yellowish, smooth or slightly papillose in the upper part, leaf above usually narrower than the sheath; costa often appearing white in the field, smooth on the back below; upper cells (about 1/3 below the apex) 10-14 μ , roundish and somewhat collenchymatous, toward the middle becoming six-sided or quadrate, cells in the sheath elongate and thin-walled, 12 x 60-120 μ . Autoicous, several male branches at the base of the seta in axils of leaves; seta about 2 cm. long; capsule when dry nearly erect to horizontal, 1 x 2 mm. to 1 x 3.5 mm., usually unsymmetric, furrowed at maturity, exothecial cells irregularly quadrate, walls smooth; mouth usually not wider than the widest part of the capsule proper; cilia with long spinose appendages throughout their length; spores 12-18 μ , lightly papillose to smooth, maturing in late spring. Type locality, Mecklenberg, Germany.

ILLUSTRATIONS:—Bry. Eur. pl. 407 (also M. H. M. pl. 43); Holzinger, Bryol. 23: 87; Husnot, Musc. Gall. pl. 75.

EXSICCATI:—Sull. and Lesq. Musc. Bor. Am. (Ed. 1) 207, (Ed. 2) 311; Austin Musc. Appal. 227; Holz. Musc. Acro. Bor. Am. 47; Canadian Musci, Geol. Surv., 560; Drumm. Musc. Am. 273 (as var. *cucullata*); Ren. and Card. Musc. Am. Sept. 183b and c (as *T. bavarica* var. *cucullata*).

Widespread from Greenland through Ontario to Vancouver Island and northward; in the United States from the Rocky Mountains east to Vermont, south to New York, New Jersey, Missouri, Arizona and California.

In rare instances here (see Holz. op. cit.) and in the other species there may be forms with large papillae in the upper part of the sheath. Many European authors use this character to separate *T. megapolitana*

from *T. bavarica* and *T. austriaca*, but in the American material this distinction does not hold. Apparently the costa is never papillose on the back below in any other species than *T. norvegica*.

1a. Forma CUCULLATA (Rich.) n. comb.

T. cucullata Rich. in Mich. Fl. Bor. Am. 2: 304. 1803.

Leaf blade wider than in the species, 1.5–2 mm., about as wide as the sheath, contracted more suddenly to the apex, often less crisped when dry. Mouth wider than the rest of the capsule when dry and mature; exothelial cells at the middle of the capsule somewhat elongated. Type locality, Canada.

ILLUSTRATIONS:—Jennings, Mosses West. Penn. pl. 25.

EXSICCATI:—Grout, Musci Perf. 214; Dutton, Vermont Musci 360; Macoun, Canadian Mosses 174a (all as *T. cucullata*); Sull. Musc. Alleg. 119 (as *T. megapolitana*); Holz. Mosses of West. Minn., July 26–27, 1901 (as *T. bavarica cucullata*).

With probably the same range as the species and grading into it, but less common. This form has been collected in Virginia, Kentucky, and Missouri, which is farther south than the species. Most of the so-called *T. cucullata* proves to be *T. megapolitana*. In leaf characters this form is to the species as *f. arctica* is to *T. austriaca*.

2. TIMMIA BAVARICA Hessel. Comment. de Timmia, 19. 1822.

T. polytrichoides Brid. Musc. Recent. 2³: 153. 1803 (in part?).

T. polytrichoides var. *viridis* Brid. Sp. Musc. 3: 99. 1817 (in part).

T. megapolitana var. *bavarica* Brid. Bryol. Univ. 2: 71. 1827.

T. austriaca var. *umbilicata* Hartm. Skand. Fl. (Ed. 2) 330. 1832.

T. austriaca var. *bavarica* Hübner. Musc. Germ. 514. 1833.

T. austriaca var. *alpina* Hartm. Skand. Fl. (Ed. 3) 292. 1838.

Plants 1–3.5 cm. tall, stems brownish-orange; leaves crisped when dry, widely spreading when wet, narrow, 0.5–1 mm., occasionally reaching 1.5 mm., 5–8 mm. long; sheath 1/5–1/6 the length of the leaf, relatively broad, usually yellow; costa smooth on the back below, sometimes papillose near the apex; leaves usually narrowed gradually to the apex; cells in the upper part 6–9 μ , thinner-walled than in *T. megapolitana*, never collenchymatous, more regularly quadrate, sheath cells 6–15 \times 50–90 μ , shorter and narrower at the margins. Autoicous, male buds in the axils of leaves on the fertile plant; seta about 1.5 cm. long; capsule ovoid, 1 \times 2–2.5 mm., almost erect to horizontal when dry, scarcely pendent when wet; exothelial cells more or less quadrate, walls mostly smooth; cilia appendiculate; spores papillose, 12–16 μ , in summer. Type locality, Fichtel Mountains, Germany.

ILLUSTRATIONS:—Möller, Arkiv för Bot. 18^o: figs. 3, 4, 5; Pl. 62.

EXSICCATI:—Bartram, Mosses of So. Ariz. 167; Canadian Musci, Geol. Surv., 561a; Wootton Pl. of New Mex. 29.

Yukon Territory, Ontario, Central Rocky Mountains, at high elevations.

With sporophyte characters near *T. megapolitana* and leaf characters between this and *T. austriaca*. In general, smaller than either, capsule more nearly globose, and spores more conspicuously papillose. From *T. megapolitana* it may be distinguished by its smaller, thinner-walled, subquadrate leaf cells and often more broadly clasping, darker sheath; from *T. austriaca* by its commonly lighter colored leaf base, autoicous habit and appendiculate cilia. Two specimens have been seen (Standley and Bollman, Pl. of N. Mex. 10996, and Macoun 586) which are unmistakably *T. bavarica* but have very slight appendiculae on the cilia. This strengthens the view that this species is intermediate between *T. megapolitana* and *T. austriaca*. (The cell characters of the leaves also intergrade.—A. J. G.)

3. TIMMIA AUSTRIACA Hedw. Sp. Musc. 176. 1801.

Mnium austriacum P. Beauv. Prodr. 74. 1805.

T. polytrichoides var. *lutescens* Brid. Sp. Musc. 3: 99. 1817.

T. megapolitana var. β Hook. and Tayl. Musc. Brit. (Ed. 2) 191. 1827.

T. lutescens Brid. Bryol. Univ. 2: 72. 1827.

Plants 4–9 cm. high, stems stout, usually reddish-orange; leaves uniform in size, sometimes imbricated when dry (especially when young), at other times crisped, squarrose-spreading when wet, 6–8 mm. long, 0.5–1.5 mm. wide above, suddenly flaring below to form the sheath, which may be 2 mm. wide, bright orange and 1/4–1/5 the length of the leaf; costa not papillose on the back below, usually ending immediately below

the apex, often toothed on the back above; upper leaf cells thick-walled but not collenchymatous, rectangular-quadrate, 6-14 μ , sheath cells long-linear, 6-9 x 64-125 μ , becoming smaller toward the margins. Dioicous; seta 3 or 4 cm. long; capsule nearly horizontal when dry, longer than in the other species, 1.5 x 4-5 mm., dark, contracted below the mouth and deeply furrowed when dry, neck tapering; exothecial cells rectangular, often rather sinuose-walled; cilia not appendiculate, but the joints large; spores 12-18 μ , slightly papillose to smooth, in summer. Type locality, Schneeberg, Austria.

ILLUSTRATIONS:—Bry. Eur. pl. 408; Dixon and James. Handb. Brit. Mosses (Ed. 3) pl. 38B; Husnot Musc. Gall. pl. 75; Braithw. Brit. Moss Fl. 2: pl. 80D; Broth. Laubm. Fennosk. fig. 64; Möller Arkiv för Bot. 18^o: figs. 1, 2; Pl. 66 D.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 248 (some of this near *f. brevifolia*); Macoun, Canadian Musci 16; Canadian Musci, Geol. Surv., 561; Cowles, Pl. of Wash. 479; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 312. Greenland, Yukon Territory, Alberta, British Columbia, Vancouver Island; in the United States, Rocky Mountains south to New Mexico, east to Nebraska.

Reaching the largest size of any of our species. The orange color of the sheath, the more or less imbricated leaves, long capsule and cilia without appendages separate this from any other species.

3a. Forma BREVIFOLIA (Ren. and Card.) n. comb.

T. austriaca var. *brevifolia* Ren. and Card. in Bot. Gaz. 238. 1894.

Plants 2-4 cm. high; leaves 4-6 mm. long, dense, imbricated when dry; seta 2.5-3 cm. long; capsule 1 x 3 mm.; spores sometimes larger than in the species. Distinguished from the species by its smaller size and more plainly imbricated dry leaves, which are not so widely spreading when wet. Young plants of *T. austriaca* are similar to older, sterile plants of this form. Type locality, Springdale, Boulder County, Colorado.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 624; Pl. of Yellowstone Park, Rocky Mt. Hb. 5913; Pl. of Yellowstone Park, U. S. Geol. Surv. (1888), spec. in U. S. Nat. Museum; Standley, Pecos Nat. Forest, N. Mex. 3998a.

Canadian Rockies south to New Mexico; common in this region.

3b. Forma ELONGATA n. forma.

Plantae circa 16 cm. altae; folia 7-8 mm. longa, late separata. Seta supra 3 cm.; capsula 1.5 x 4 mm.; spores 12-18 μ .

Plants about 16 cm. tall; leaves 7-8 mm. long, spaced far apart, spreading when wet and dry. Seta over 3 cm.; capsule 1.5 x 4 mm.; spores 12-18 μ . A habitat form, at the opposite extreme to *f. brevifolia*. Type locality, upper valley of Nesqually, Cascade Mountains, Washington.

EXSICCATI:—Allen, Mosses of Cascade Mountains 75 (as *T. austriaca*). Type.

3c. Forma ARCTICA (Kindb.) Arn. in Öfv. Vet.-Akad. Föhr. 57: 114. 1900.

T. arctica Kindb. in Bot. Notis. 258. 1893.

Plants scarcely tufted, 3-4 cm. high; leaves linear, more or less crisped, broader than in the species (about 1.5 x 7 mm.), suddenly contracted to the obtuse apex, weakly sheathing, not squarrose when wet; sheath pale yellow; costa toothed on the dorsal side above; upper cells 7.5-10.5 μ , sheath cells about 6 x 60-100 μ . Sporophyte unknown. Type locality, Greenland.

EXSICCATI:—Danish Exp. of 1891-92, Nat. Mus. Canada spec. 14514. Swamps in arctic districts; Greenland.

4. TIMMIA NORVEGICA Zett. Öfv. Vet.-Akad. Föhr. 19: 364. 1862.

T. megapolitana var. *norvegica* Lindb. Öfv. Vet.-Akad. Föhr. 21: 337. 1864.

Plants 2-8 cm. high, light green above, stems red-brown; leaves 4-10 mm. long, about 1.5 mm. wide, barely sheathing; sheath short, less than 1/8 the length of the leaf; costa papillose on the back below, usually ending below the apex, sometimes almost excurrent; margins toothed to about half way down; lamina usually coarsely papillose on the dorsal side except for the extreme basal cells of the sheath; base of the costa red, a strip of red cells present in mature leaves across the sheath, below this a hyaline region; leaf cells

above, 12–15 μ , subquadrate, cells of the sheath 6–12 x 50–90 μ ; a group of shorter, fragile, colorless cells at the base of the sheath on both sides of the costa, extending as many as 10 cells up, often remaining on the stem when the leaf is removed. (Dioicous; seta 2 cm. long; capsule horizontal, elongate-ovoid, from a short neck; spores 19–23 μ , smooth, July and August. From Limpricht, after Juratzka). Type locality, Dovrefjeld Mountains, Norway.

ILLUSTRATIONS:—Dixon and James. Handb. Brit. Mosses (Ed. 3) *pl.* 38 C; Husnot Musc. Gall. *pl.* 75; Braithw. Brit. Moss Fl. 2: *pl.* 80E; Möller, Arkiv för Bot. 18^o: *figs.* 9, 10; *Pl.* 66, E.

EXSICCATI:—Plants of the Peary Polar Exp., Grant Land, 13, specimen in the U. S. Nat. Mus.

In fissures of calcareous rocks in arctic regions; Greenland, Grant Land, Athabasca. Seldom collected in North America. The fragile basal cells and the papillae on the lower part of the costa are unmistakable.

AULACOMNIACEAE.*

BY GENEVA SAYRE.

Plants in dense or loose tufts, green to yellowish-green above, brown below, usually tomentose, growing by yearly innovations that often give the plant a bushy appearance; central strand distinct; leaves variously shaped, smooth to papillose; costa ending below the apex to excurrent; upper leaf cells small; vegetative reproduction common. Autoicous or dioicous; capsule elongate, erect to horizontal; annulus present; peristome double. Two genera, *Leptotheca* Schwaegr. in the southern hemisphere, and the following:

AULACOMNIUM Schwaegr. Suppl. 3¹: 1. *pl.* 215. 1827. *Nomen conservandum.*

Arrhenopterum Hedw. Sp. Musc. 198. 1801.

Hypnum Web. and Mohr. Ind. Pl. Crypt. 1803.

Mnium Brid. Musc. Rec. 2^o: 85. 1803.

Orthopyxis P. Beauv. Prodr. 31. 1805.

Bryum Sw. Summa Veg. Scand. 41. 1814.

Gymnocephalus Schwaegr. Suppl. 1^o: 87. 1816.

Fusiconia P. Beauv. Mém. Soc. Linn. Paris, *pl.* 7, *fig.* 5. 1822.

Bryum subg. *Streptotheca* Arn. Dispos. Meth. 43. 1825.

Gymnocybe Fries, St. Agr. Fems. 27. 1825.

Peromnion Schwaegr. Suppl. 3¹: 250. 1828. emend. Montagne.

Limnobryum Rabenh. Kryptfl. Sachs. 1: 502. 1863.

Sphaerocephalus Lindb. Musc. Scand. 14. 1879.

Leaves decurrent, elongate-ovate to narrowly lanceolate, cucullate to acuminate, entire to denticulate; costa strong, ending near the apex, guide cells in a single row; *upper leaf cells* small, thick-walled, *usually incassate, with a single papilla on front and back*, lower cells either slightly elongate in a single layer or swollen and rectangular in several layers; *pseudopodia often present*, bearing at the summit fusiform or leaf-like brood bodies. Autoicous or dioicous; antheridia short-stalked, paraphyses unbranched; seta smooth, twisted; *capsule* suberect to horizontal, curved or symmetric, when dry contracted below the mouth and *longitudinally striate*, striations marked in the rectangular exothecial cells by thinner- and thicker-walled regions, about 5 rows of small, thick-walled cells at the mouth; stomata in the lower part; calyptra cucullate, narrow, about as long as the capsule, set on obliquely; operculum conic to rostrate; annulus large, usually 2-seriate; *outer peristome teeth* about 0.5 mm. long, narrow, *pale yellow and almost smooth in the lower 2/3, hyaline and minutely papillose in the upper 1/3*; inner peristome thin, minutely papillose, membrane reaching the middle of the outer teeth, 2–4 cilia between the segments.

Type species, *A. androgynum*. A rather common genus, except in the southern part of the range, growing especially in mountainous regions, but not confined to high altitudes. On earth, fissures of rocks, rotten wood and the bases of trees.

KEY.

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|--|---------------------------|
| 1. Leaves elongate-ovate, strongly toothed in the upper 1/2–2/3..... | 1. <i>heterostichum</i> . |
| Leaves (at least the lower) lanceolate, or when ovate entire..... | 2. |

* Contributions from The Department of Botany and The Rocky Mountain Herbarium, University of Wyoming, No. 157.

- | | |
|---|------------------------------|
| 2. Leaves entire, usually cucullate at the apex | 4. <i>turgidum</i> . |
| Leaves crenulate to serrate at the apex, usually acute | 3. |
| 3. Basal cells not swollen, brood bodies fusiform; spores 7-10 μ | 2. <i>androgynum</i> . |
| Basal cells swollen, brood bodies when present leaf-like; spores 10-12 μ | 4. |
| 4. Upper leaves oval, crowded at the tips of innovations, lower leaves much smaller, lanceolate | 3a. var. <i>congestum</i> . |
| Leaves gradually smaller down the stem | 5. |
| 5. Leaves somewhat ovate, imbricated when dry | 3b. var. <i>imbricatum</i> . |
| Leaves lanceolate, usually contorted when dry | 3. <i>palustre</i> . |

1. AULACOMNIUM HETEROSTICHUM (Hedw.) Bry. Eur. fasc. 10. 1841.

Arrhenopterum heterostichum Hedw. Sp. Musc. 198. 1801.

Bryum heterostichum W. Arn. Mém. Soc. d'Hist. Nat. Paris 2: 292. 1825.

Hypnum heterostichum Web. and Mohr. Ind. Pl. Crypt. 1803.

Mnium membranaceum Brid. Musc. Rec. 2³: 85. 1803.

Mnium Arrhenopterum Sm. Trans. Linn. Soc. 263. 1804.

Orthopyxis heterosticha P. Beauv. Prodr. 79. 1805.

Primary stems about 1 cm. long, plants growing to at least 4 or 5 cm., innovations occasionally somewhat flagellate, plants a clear green above, loosely tufted; *leaves dense, erect, not crisped* when dry, often inclined in one direction, decurrent, *elongate-ovate*, usually obtuse and apiculate, sometimes almost acute, 1-1.5 x 2-3 mm., margins plane or slightly recurved, *coarsely toothed in the upper 1/2-2/3*, teeth becoming smaller toward the middle of the leaf, costa stout at the base, becoming much narrower above and ending below the apex, sometimes forked above; *upper leaf cells rounded or ellipsoidal*, with very small papillae, 9-16 μ , *incrassate, those at the base in a single layer*, usually longer than those above. Autoicous, male buds small, sessile, in the axils of leaves along the fertile plant; seta 1-1.5 cm. long; capsule suberect, slightly unsymmetric, 6-8 striate, about 2.5 mm. long and 1 mm. wide, sometimes narrower; operculum beaked; cilia 2 or 3 between the segments; spores 9-12 μ , slightly papillose, in early summer. Type localities, Virginia, and Lancaster, Pennsylvania.

ILLUSTRATIONS:—Bry. Eur. *pl.* 403; Hedw. Sp. Musc. *pl.* 46, *figs.* 1-9; Broth. in Engler & Prantl (Ed. 2) 10: *fig.* 388A-D; Jennings, Mosses W. Pa. *pl.* 24; M. H. M. f. 100.

EXSICCATI:—Austin, Musc. Appal. 220; Sull. and Lesq. Musc. Bor. Am. (Ed. 1) 206, (Ed. 2) 310; Holz. Musc. Acro. Bor. Am. 46; Canadian Musci, Geol. Surv., 559; Small, Georgia Mosses 433 and 5082; Grout, Musci Perfecti 212; R. & C. Musc. Am. Sept. 65; Sull. Musc. Allegh. 106.

Ontario south to Florida and Texas, west to Minnesota and Kansas.

2. AULACOMNIUM ANDROGYNUM Schwaegr. Suppl. 1²: 87. 1816.

Orthopyxis androgyna P. Beauv. Prodr. 32 and 78. 1805.

Gymnocephalus androgynus Rich. Schwaegr. Suppl. 1²: 87. 1816.

Fusiconia androgyna P. Beauv. Mém. Soc. Linn. Paris 1: 7. *fig.* 5. 1822.

Gymnocybe androgyna Fries, St. Agr. Fems. 27. 1825.

Bryum (Streptothea) androgynum W. Arn. in Mem. Soc. d'Hist. Nat. Paris 2: 291. 1825.

Mnium androgynum Lindb. Musc. Scand. 14. 1879.

Plants in tufts, usually 2 or 3 cm. high, occasionally reaching 7 cm., yellowish-green to green above, more or less tomentose throughout, innovations about 5 mm. long; *leaves* 1.5-5 mm. long, slightly crisped when dry, *lanceolate, acute, narrowly revolute on the margins below* and sometimes to the apex, *serrate to crenulate at the apex*, papillae reaching 6 μ high; costa stout, 1/4-1/5 the width of the leaf at the base, ending slightly below the apex or occasionally percurrent; upper leaf cells rounded, 7.5-12 μ , deeply incrassate; *lower cells and those in the decurrent region in a single layer*, scarcely differentiated or longer and somewhat thinner-walled; *pseudopodia usually present*, 2-3 mm. long, *bearing at the summit a round head of small fusiform brood bodies* about 0.5 mm. long. Dioicous, antheridia in terminal gemmiform buds; seta about 2 cm. long; capsule oblong-cylindric, about 3 mm. long and 1 mm. wide, suberect to horizontal, almost symmetric, 6-8 striate; operculum conic, about 1 mm. high; cilia 2 or 3 between the segments of the inner peristome; spores 7-10 μ , pale, smooth, in early summer. Type locality, Giessen, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl.* 406; Husnot, Musc. Gall. *pl.* 72; Engler & Prantl (Ed. 2) 10: *fig.* 388H-J; Braithw. Brit. Moss Fl. 2: *pl.* 80C; Dixon and James. Handb. Brit. Mosses (Ed. 3) *pl.* 38A; Lotsy, Botan. Stam. 2: *fig.* 211; *Pl.* 66, C.

EXSICCATI:—Sull. and Lesq. Musc. Bor. Am. (Ed. 1) 205, (Ed. 2) 309; Holz. Musc. Acro. Bor. Am. 198; Canadian Musci, Geol. Surv., 556; Allen, Mosses Cascade Mts. 73; Baker, Pac. Slope Bryoph. 578; Howe, Musc. Calif., Hb. Univ. of Calif., 47.

Vancouver Island, British Columbia to Newfoundland and Labrador; in the United States south to N. Y., Michigan, Montana, Idaho and Oregon.

3. AULACOMNIUM PALUSTRE (Web. and Mohr.) Schwaegr. Suppl. 3¹: 4. 1827.

Hypnum palustre (not Huds.) Web. and Mohr. Ind. Mus. Pl. Crypt. 1803.

Orthopyxis palustris P. Beauv. Prodr. 32 and 79. 1805.

Hypnum elodes (not Spruce) Web. and Mohr. Bot. Taschenb. 272. 1807.

Gymnocybe palustris Fries, St. Agr. Fems. 27. 1825.

Bryum (*Streptotheca*) *palustre* W. Arn. in Mém. Soc. d'Hist. Nat. Paris 2: 291. 1825.

Limnobryum palustre Rabenh. Kryptfl. Sachs. 1: 502. 1863.

Aulacomnium papillosum C. Muell. Flora 58: 93. 1875.

Sphaerocephalus palustris Lindb. Musc. Scand. 14. 1879.

Plants tufted to solitary; stems much branched to almost unbranched, yellow-green above, tomentum coarse; leaves long-lanceolate, reaching 0.75 x 4 mm., crisped when dry, more or less flexuous, crowded to distant, uniform along the stem (or the lower leaves becoming gradually shorter and broader), acute to slenderly acuminate, feebly to coarsely papillose, papillae reaching 7.5 μ ; costa stout, ending below the apex; margins revolute below the upper 1/4, more or less denticulate near the apex; upper leaf cells somewhat incrassate, angular, sinuose-walled, 9-18 μ , basal cells swollen, rectangular, 10-16 x 15-25 μ , sometimes brown; pseudopodia about 5 mm. long, occasionally branched above, naked or with minute ecostate leaf-like brood bodies in a cluster at the summit, and sparingly along the axis. Dioicous, male flower a terminal rosette; perigonal leaves scarcely different from the stem leaves; seta 2-4 cm. long; capsule 3-4 mm. long by 1 mm. wide, somewhat unsymmetric, suberect to horizontal, 8-12-striate; operculum conic, usually straight; cilia 3-4 between the segments of the inner peristome; spores 10-12 μ , smooth, in early summer. Type locality, European; the plant was known to Dillenius from Giessen, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl.* 405; Husnot, Musc. Gall. *pl.* 72; Braithw. Brit. Moss Fl. 2: *pl.* 80 A; Limpr. Laubm. 2: *fig.* 310A-B; Dixon and James. Handb. Brit. Mosses (Ed. 3) *pl.* 37H; Jennings, Mosses W. Pa. *pl.* 24; M. H. M. *figs.* 101 & 102; *Pl.* 66, A.

EXSICCATI:—Drumm. Musc. Am. 242; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 308; R. & C. Musc. Am. Sept. 380; Austin, Musc. Appal. 218 and 219; Canadian Musci, Geol. Surv., 557 and 557b (as var. *polyccephalum*); Holz. Musc. Acro. Bor. Am. 71; Allen, Mosses of Cascade Mts. Wash. 74; Sull. Musc. Allegh. 104; Reliquiae Farlowianae (Musc.) 553; *Pl.* of California, Bolander 63.

Widespread, Alaska to Greenland, from Washington across the northern and central United States to New England and New York, south to Florida, New Mexico and California.

3a. Var. CONGESTUM Boulay, Muscin. d. l. France 224. 1884.

Plants 1.5-5 cm. high, much branched, innovations bearing at their tips a cluster of large, ovate leaves about 1 x 2.5 mm., and along the stem below small, lanceolate leaves not over 1.5 mm. long; upper leaves imbricated, blunt, usually cucullate, almost entire, papillose, cell walls slightly sinuose; lower leaves more or less contorted when dry; basal cells not discolored. The upper leaves are similar to those of *A. turgidum*, the lower as in *A. palustre*. Type locality, France.

EXSICCATI:—Holz. Musc. Acro. Bor.-Am. 627 and Ikenberry, North Dakota (both as *A. palustre imbricatum*); Moss, Alberta (as *A. turgidum*); Labrador Mosses, Waghorne 9. Miquelon, British Columbia, Alberta, North Dakota.

3b. Var. IMBRICATUM Bry. Eur. fasc. 10. 1841.

Gymnocybe palustris var. *imbricatum* Lindb. de. Mn. Europ. 87. 1868.

Mnium palustre var. *imbricatum* C. Muell. Syn. Musc. 1: 170. 1849.

Plants about 5 cm. high, usually sparingly branched; leaves imbricated, usually crowded along the stem, becoming gradually smaller below, somewhat serrate, broader than the species (about 3 mm. long and 1 mm,

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wide), acute and usually apiculate, reflexed on the margin from about the upper 1/4 down, papillose, cells sinuose-walled. Resembling *A. turgidum*. Type locality, Salzburger Alps.

EXSICCATI:—Sull. and Lesq. Musc. Bor. Am. (Ed. 1) 205; Canadian Musci, Geol. Surv., 557a; J. N. Rose (northwest, Wyoming) 709.

Newfoundland, Ontario, British Columbia, Vancouver Island, eastern United States.

Other varieties have been reported from this region. The following are here included with the species: var. *polycephalum* (Brid.) Hueb. with numerous pseudopodia; var. *alpestre*, a short, slender form; var. *laxifolium* Kindb., "leaves laxly disposed." The var. *fasciculare* (Funck) Bry. Eur., with flagellate branches, seems not to occur in North America. *A. pygmaeum* (Holz.) Holz. (Musc. Acro. Bor. Am. and Eur. 628 from Hot Springs, Halcyon, B. C.) is too young to place with certainty. A form with large papillae has been called *A. papillosum* (C. M.) Jaeg., but the opinion of the writer is as that of Miss Addison (Bryol. 37: 76. 1934) that this should be included in *A. palustre*.

4. AULACOMNIUM TURGIDUM (Wahl.) Schwaegr. Suppl. 3¹: 7. 1827.

Hypnum turgidum Wahl. ms, Web. and Mohr. Ind. Musc. Pl. Crypt. 1803.

Mnium Arrhenopterum Sm. Trans. Linn. Soc. 7: 263. 1804 (in part).

Arrhenopterum turgidum Wahl. ms, Web. and Mohr. Bot. Taschenb. 318. 1807.

Mnium turgidum Wahl. Fl. Lappl. 351, pl. 23. 1812.

Bryum turgidum Sw. Summa Veg. Scand. 41. 1814.

Gymnocybe turgida Lindb. Not. Saellsk. pro Faun. et Fl. Fenn. Förh. 9: 85. 1867.

Sphaerocephalus turgidus Lindb. Musc. Scand. 14. 1879.

Plants yellow-green above, 3–8 cm. high, or occasionally higher, reaching the largest size of any of the species, usually tufted, sparingly branched; stems breaking easily, usually tomentose at least below the upper 5 mm., yearly innovations about 2 cm. long; leaves imbricated, elongate-ovate to oblong, narrowed gradually to the base, 0.8 x 2 to 1.5 x 3.5 mm., entire, concave, cucullate at the tip, more or less revolute except in the upper 1/4, somewhat decurrent, papillae indistinct to coarse, occasionally reaching 4 μ ; costa ending below the apex, about 1/4 the width of the leaf at the insertion, thin above and sometimes forked; upper leaf cells irregularly angular, sinuose-walled, 9–15 μ ; basal cells brown, swollen, rectangular, in two or three layers. Dioicous, male flower a terminal rosette. (Seta 1.5–2.5 mm. long; capsule inclined, 1.2 x 3.6 mm., curved, yellow-brown, 8-striate; lid not beaked; spores 10–13 μ , yellowish, smooth, in July. Limpr. Laubm. 2: 530. 1895.) Type locality, Scandinavia.

ILLUSTRATIONS:—Bry. Eur. pl. 404; Engler & Prantl (Ed. 2) 10: f. 388E-F; Braithw. Brit. Moss Fl. 2: pl. 80B; Dixon and James. Handb. Brit. Mosses (Ed. 3) pl. 37G; Pl. 60, B.

EXSICCATI:—Austin, Musc. Appal. Suppl. 1, 517; Sull. and Lesq. Musc. Bor.-Am. (Ed. 1) 204; Holz. Musc. Acro. Bor.-Am. 325; Drumm. Musc. Am. 243; Sull. Musc. Allegh. 105; R. & C. Musc. Am. Sept. 226b.

Alaska, Lake Superior Region, White Mountains of New Hampshire, Adirondack Mountains. Fruit rare.

Family BARTRAMIACEAE

BY SEVILLE FLOWERS, PH.D.

Plants caespitose, small to tall-robust, often densely tomentose below; stems variously branched, mostly fastigiate or whorled. Leaves variable, linear to broadly ovate-lanceolate, base plane or clasping; costa long, ending below the apex or long-excurrent, often stout and broad; margins plane or revolute, serrate; cells variable, mostly oblong to linear, papillose by the projection of the end walls, smooth in a few species, basal cells usually enlarged.

Seta short or long; capsules variable, mostly globose to ovoid, few oblong, mostly inclined or cernuous, longitudinally furrowed when dry (except *Anacolia*, *Catoscopium* and *Bartramidula*). Peristome double, single and degenerate, or lacking; lid convex to conic (beaked in *Conostomum*); spores globose to reniform, papillose or warty.

A large but natural family, variable in many characters but all (with the exception of *Catoscopium*) have many features in common. The habit, leaf structure, papillose cells, serrate margins, well defined costae, capsule and peristome characters, occur in combinations that definitely relate the various members. Plants with strongly inclined or cernuous capsules have a well developed double peristome while those with erect or slightly inclined capsules have the peristome single, degenerate or lacking.

Catoscopium is the only questionable genus placed in this family. The capsule is very small and dark reddish-brown with a very short peristome. The leaves are smooth. It has been placed in the Meesiaceae by various authors.

KEY.

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| 1. Stems 3-angled with a loose outer layer of cells; leaves smooth | 5. <i>Plagiopus</i> . |
| Stems 5-many-angled; leaves smooth or papillose | 2. |
| 2. Plants very small, 1 cm. high or less; leaves 1 mm. long or less | 3. |
| Plants larger, 1 cm. high or more; leaves 1 mm. long or longer | 4. |
| 3. Capsules strongly inclined or cernuous, furrowed when dry; dioicous, autoicous or polygamous | 8. <i>Philonotis</i> . |
| Capsules erect or slightly inclined, rugulose when dry, gymnostomous; synoicous .. | 7. <i>Bartramidula</i> . |
| 4. Leaves linear to linear-lanceolate; capsules furrowed when dry | 6. <i>Bartramia</i> . |
| Leaves lanceolate or broader (except in <i>Anacolia</i>) | 5. |
| 5. Capsules not furrowed when dry | 6. |
| Capsules furrowed when dry | 7. |
| 6. Leaves closely appressed when dry, yellowish-green to green; stems densely reddish tomentose; seta short, capsules erect, large, rugulose when dry, yellowish-brown | 3. <i>Anacolia</i> . |
| Leaves not appressed, green; stems not reddish tomentose; capsules cernuous, very small, dark reddish-brown, smooth, seta long | 1. <i>Catoscopium</i> . |
| 7. Leaves strongly keeled, appressed and strict, in 5 distinct rows; lid beaked | 2. <i>Conostomum</i> . |
| Leaves not keeled, not in rows, or if so not strict; lid not beaked | 8. |
| 8. Cells uniform, linear to the base; plants large 2-4 cm.; seta short 1.5-2 cm. | 4. <i>Breutelia</i> . |
| Cells enlarged at the base, or if uniform, plants smaller; seta long | 8. <i>Philonotis</i> . |

1. CATOSCOPIUM Brid. Byol. Univ. 1: 368. 1827.

Plants densely tufted; stems slender, branched; leaf cells smooth, oblong to rectangular or quadrate; insertion plane. Dioicous; seta long and slender; capsules globose to ovoid, unsymmetric, inclined when moist, curved and cernuous when dry, mouth directed downward. Peristome single. Monotypic.

CATOSCOPIUM NIGRITUM Brid. l. c.

Weisia nigrita Hedw. Sp. Musc. 72. 1801.

Plants in dense cespitose tufts, dark brownish-green below, the tips bright green; stems slender, 2-5 cm. high with dense rhizoids below; leaves somewhat crisped when dry; 1.2-1.5 mm. long, lanceolate-acuminate, the apex subulate; costa narrow but strong, ending below the tip or slightly percurrent; apical cells rectangular to quadrate, median cells oblong to sublinear, becoming shorter at the margins, 4-8 μ wide; basal cells much the same but somewhat more uniformly oblong, slightly larger. Dioicous; perigonia terminal, gemmiform; leaves ovate at the base, concave, rather abruptly narrower to the lanceolate apex; seta long, 1-1.5 cm., reddish or dark brown, paler above; capsule small, 0.7-1 mm. long, subglobose with a short neck which often becomes twisted when dry, inclined to subpendent, dark reddish-brown to nearly black, shiny, brittle, smooth, the mouth small and pointing downward when dry; lid convex-conic with a blunt point; annulus none; teeth 16, irregular and poorly developed, short, consisting of 2-5 joints, irregularly thickened, very fragile, when complete short, lanceolate, finely papillose. Type locality, European.

ILLUSTRATIONS:—Brid. l. c. pl. 4; Bry. Eur. pl. 313; Dixon & Jam., Handb. Brit. Mosses, (Ed. 3). pl. 38D; Limpr. Laubm. 2: 519, f. 309; Pl. 67 E.

EXSICCATI:—McCall 173; Moxley, no number; Grout, Musci Perfecti 167; Macoun, Can. Musci 154; R. & C. Musc. Am. Sept. 296; Drumm. Musc. Am. 73.

On damp soil and sandy lake shores. This plant is rather rare and seems to be more frequent in the Great Lakes region and Rocky Mts.; Alaska, British Columbia, Montana. In the sterile form it resembles certain of the *Dicranaceae* but the presence of the capsules make its recognition very easy.

This anomalous moss has a capsule resembling that of *Discelium* but the vegetative characters are not at all alike. The teeth are seldom entire, either having been broken or are imperfectly formed.

2. CONOSTOMUM Sw. N. Jour. f. Bot. 1³: 26. 1806.

Plants in dense tufts; leaves appressed and imbricated both wet and dry, small, in 5 distinct rows, cells oblong to rhomboidal, insertion plane. Dioicous; capsules ovoid to oblong, inclined, furrowed when dry; peristome single, teeth long-lanceolate, united by their tips in form of a cone. Type species, *C. boreale*.

CONOSTOMUM BOREALE Swartz. l. c. pl. 5.

Conostomum tetragonum [Dicks.] Lindb. Öfv. K. Vet.-Ak. Förh. 20: 8. 1863.

Tufts dense with interwoven dark brown tomentum below, yellowish-green or glaucous above; stems strict and slender, 2-4 cm. high, branched sparingly, rather brittle and often broken, 5-angled in cross-section; leaves appressed and imbricated in five distinct rows, often slightly spirally arranged, lanceolate to oblong-lanceolate, 1-1.5 mm. long, the lower ones shorter; costa broad at the base, tapering and disappearing below the apex or percurrent in the lower leaves, shortly excurrent in the upper ones, forming a sharp keel when dry; margins entire below, sharply serrate at the extreme apex, plane or narrowly revolute near the base; median cells oblong, rectangular or rhomboidal, 10-15 μ wide, narrower toward the margin; basal cells larger; some of the upper cells faintly papillose at the ends. Dioicous; perigonium discoid, outer bracts with a broadly ovate, concave base, inner ones shorter; seta 2-3 cm. long; capsule inclined or cernuous, ovoid to shortly oblong, unsymmetric, gibbous above, 2.5-3 mm. long; mouth oblique, irregularly furrowed when dry; lid conic with a beak which is often turned upward; peristome single, teeth linear-lanceolate, strongly barred, papillose at the base, pale-margined, united at the tips; spores reniform, coarsely papillose, large, 40-50 μ . Type locality, Switzerland.

ILLUSTRATIONS:—Braithw. Brit. Moss Fl. 2: pl. 764; Limpr. Laubm. 2: 552; Broth. Laubm. Fennoscand. 353; Husnot, Musc. Gall. pl. 73; Bry. Eur. pl. 322; Monkemeyer, Laubm. Eur. 578; Dixon & Jam. Handb. Brit. Moss. (Ed. 3). pl. 38E; Pl. 67 F.

EXSICCATI: Holz., Musc. Acro. Bor. Am. 456; Trelease & Saunders 2281, 2486, 2487; Trelease 2137, 2138, 2484; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 173, (Ed. 2) 261; Sull. Musc. Allegh. 120; Drumm. Musc. Am. 53.

On wet soil and in crevices at high elevations. Apparently northern, Maine, New Hampshire, British Columbia, Alaska, Labrador and Greenland.

A very distinct moss recognized by its slender strict stems, 5-angled in cross section, large capsule and single peristome.

*3. ANACOLIA (Schimp.) emend. Holz. Bryol. 7: 28. 1904.

Schimp. Syn. (Ed. 2). 513. 1876.

Plants caespitose or in loose yellowish-green tufts cohering below by dense felt-like rhizoids, brownish and roughened or prickly papillose. Stems monopodially or dichotomously branched, 3-10 cm. long, 8-angled and roughly papillose. Leaves closely appressed when dry, open erect to patent or subspreading when moist, often slightly recurved, at base ovate, concave with a single strong plica on either side, narrowed to a lanceolate or linear-aristate apex; costa stout, percurrent to long excurrent; margins narrowly revolute half way or more, strongly serrate above; upper cells rectangular to oblong or subrhomboidal, 3-6 μ wide, smooth or papillose, basal cells slightly or greatly enlarged. Dioicous; perigonia terminal or lateral by innovation, gemmiform; bracts very narrow from a broadly ovate, concave base; seta lateral by innovation, 5-15 mm. long; capsule erect or slightly inclined, subglobose, ovoid or cylindric, 2-2.8 mm. long, leptodermous, rugulose when dry; peristome of 16 imperfect teeth, irregular, short, arising half their length below the mouth of the capsule, very fragile and often lacking; lid convex, obtuse; spores reniform, 22-26 μ , papillose.

KEY.

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|---|--------------------------|
| 1. Basal cells oblong and much enlarged; leaves bistratose above, cells papillose . . . | 1. <i>laevisphaera</i> . |
| Basal cells rectangular to quadrate, not much enlarged; leaves unistratose, cells | |
| smooth or very faintly papillose | 2. |
| 2. Costa percurrent or shortly excurrent; leaves 2.5-3.5 mm. long | 3. |
| Costa long-excurrent; leaves 4-5 mm. long | 4. |

* Conserved as against *Glyphocarpus* Brid. 1827, by the International Congress at Cambridge, England in 1930.

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| 3. Capsules subglobose to ovoid | 2. <i>Menziesii</i> . |
| Capsules oblong to cylindric | 2a. var. <i>Baueri</i> . |
| 4. Leaves lanceolate to lanceolate-linear | 2b. var. <i>grandifolia</i> . |
| Leaves linear-aristate from an ovate base | 3. <i>aristifolia</i> . |

1. ANACOLIA LAEVISSPHAERA (Taylor) n. comb.

Glyphocarpus laevisphaerus Taylor, Lond. Journ. Bot. 1846: 56. 1846.

Bartramia subsessilis Taylor, Lond. Journ. Bot. 1847: 334. 1847.

Anacolia subsessilis (Taylor) Broth. Engler & Prantl (Ed. 1) Musci 1: 634. 1909.

Plants in dense yellowish-green tufts much like *A. Menziesii* but somewhat smaller; stems branched, 3-5 cm. long, densely reddish-brown tomentose below, curved or flexuose; leaves closely appressed when dry; patent when moist, narrowly lanceolate from an ovate base, plicate on either side, *papillose to the base*, 3 mm. long, costa very stout and percurrent; margins narrowly revolute, entire below, coarsely serrate above; *upper lamina bistratose*; cells rectangular to oblong, 4-6 μ wide; *basal cells elongated*, oblong, 7-10 μ wide, becoming shorter at the margin, quadrate to rectangular. Type locality South America.

ILLUSTRATIONS:—*Pl. 68 G.*

EXSICCATI:—Bartram, Mosses of S. Arizona, 110, Holz. Musc. Acro. Bor. Am. 551.

"Infrequent on ledges," Bartram. Our only representative was collected in the Santa Rita Mts. of Arizona by Bartram. This station seems to be the northern limit of the species thus far recorded. It occurs in Mexico.

The short leaves with bistratose lamina, elongated basal cells, and prominent papillae make this species easy to separate from its relatives.

2. ANACOLIA MENZIESII (Turn.) Paris, Index (Ed. 1) 1: 27. 1894.

Bartramia Menziesii Turn. Koen. & Sims, Ann. Bot. 1: 525. *pl. 2, f. 1.* 1805; Brid. Bryol. Univ. 2: 48. 1827; L. & J. Manual 204. 1884.

Plants in caespitose tufts interwoven below with dense reddish tomentum; stems branched, 8-angled, papillose, 3-5 cm. high, yellowish-green; leaves appressed when dry, patent to subspreading when moist, 2.5-3.5 mm. long, narrowly lanceolate, base ovate with a strong fold on either side; costa stout, *percurrent or shortly excurrent*, somewhat papillose on the inner face; margins narrowly revolute, serrate above; upper cells oblong to rectangular, 7-10 μ wide, a few narrower and flexuose or rhomboidal, smooth or slightly papillose, bistratose in lines; *basal cells rectangular to quadrate*, 8-12 μ wide. Dioicous; perigonia lateral by innovation, gemmiform, bracts narrower than the stem leaves, base broadly ovate and concave, subsheathing, usually colored; seta lateral by innovation, 5-10 mm. long; capsules slightly exceeding the stem tips or immersed, subglobose to ovoid, 2.2-2.5 mm. long, base often with a distinct neck, leptodermous, rugulose when dry, mouth rather small; peristome of 16 teeth, often imperfect, yellowish or pale to reddish-brown, very fragile, often falling with the lid; lid conic, obtuse; spores reniform to globose, 28-32 μ , papillose.

ILLUSTRATIONS:—Sull. Icones Musc. *pl. 26; Pl. 68 H.*

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 259; Holz. Musc. Acro. Bor. Am. 165; Bennett, 259; R. & C. Musc. Am. Sept. 53.

On rocks and in crevices, usually in the shade; California to British Columbia and Alaska.

The exact status of *Anacolia Menziesii* and *A. Baueri* was open to question for some time. Holzinger called attention to certain characters of these plants and emended certain features including the genus (Bryologist 7: 28. 1904). He pointed out contrasting features of the capsules, namely, that *A. Menziesii* shows a distinct neck with a loosely hung spore sac ending higher than in the capsule of *A. Baueri*, which differs in being oblong to cylindric. I find that the neck is not very distinct in some specimens of *A. Menziesii* but well defined in others. Further, *A. Baueri* often shows a distinct neck and therefore only the shape of the capsule remains as characteristic feature. The spores of *A. Menziesii* are 28-32 μ while those of *A. Baueri* are smaller, 18-22 μ . Holzinger made a very significant observation which I was not able to verify, namely, the presence of a "solitary ghost-like translucent real tooth" in *A. Menziesii*. In all the capsules I examined the teeth were either single, imperfect or lacking, usually very fragile and often found in the lid. According to Holzinger's interpretation these so-called teeth that are in evidence represent the inner peristome and that the real teeth are either lacking or are so fragile that they fall with the lid. His note regarding the papillae on the rhizoids states that they are not very prickly. I find that the smaller rhizoids are merely roughened and that the larger well developed ones are decidedly prickly-papillose.

The species is extremely variable and the size and length of the leaves differ markedly with the habitat. The original description calls for leaves with percurrent costae but plants with this character predominating

are rare. I have seen specimens collected on dry rocks in sagebrush land with short leaves nearly all of which show a percurrent costa while other specimens from deep shaded habitats of humid regions show leaves 4-5 mm. long and with a long-excurrent costa. All gradations between these extremes are very common. I could find no significant difference between the leaves of *A. Menziesii* and *A. Baueri*.

2a. Var. *BAUERI* (Hampe) Paris, Index (Ed. 1) 1: 27. 1894.

Glyphocarpa Baueri Hampe, Linn. 33: 457. 1859.

Much like *A. Menziesii* in vegetative characters but the leaves are somewhat longer and the costa mostly shortly excurrent. The seta 7-10 mm. long, lateral by innovation; capsule oblong to cylindric, often with a short neck, 2.4-2.8 mm. long, yellowish- or reddish-brown; peristome lacking or composed of 16 irregular short teeth arising half their length below the mouth, lanceolate or shorter and blunt; lid conic, obtuse; spores globose to reniform, papillose, 18-22 μ . Type locality, California.

ILLUSTRATIONS:—*Pl. 68 H*, 5-8.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 602; Macoun, Can. Musci 151; Howe, Musci Calif. 48b; Ren. & Card. Musc. Am. Sept. 220; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 260; Grout, Musci Perfecti 305. On rocks and in crevices of cliffs in shaded places. It is said to occur in drier places than *A. Menziesii*.

Forma *GRANDIFOLIA* n. forma.

Folia grandia, 3.5-5 mm. longa, lanceolata-aristata; costa longe excurrentia.

Plants robust in caespitose tufts 5-12 cm. high; stems densely reddish tomentose below, branched; leaves appressed when dry, green or yellowish-green, open erect to widely patent when moist, lanceolate-aristate, 3.5-5 mm. long; costa stout and long-excurrent, often extending 1 mm. beyond the lamina of the leaf. Seta 6-8 mm. long; capsule immersed or emergent above the tips of the stems, globose to ovoid, 2-2.2 mm. long, without neck; lid convex, obtuse; spores globose to reniform, 26-28 μ , papillose. Type locality, Idaho, (Leiberg 122). Type in herbarium of the New York Botanical Garden.

ILLUSTRATIONS:—*Pl. 68 H*, 9-15.

EXSICCATI:—Leiberg 122; Macoun, Can. Musci 195, 118.

On shaded rocks, Idaho, Washington and British Columbia.

This plant is related to *A. Menziesii* differing in the larger size, larger leaves with constantly long-excurrent costae and a somewhat larger capsule. From var. *Baueri* it differs in the shorter capsule although more closely related in leaf structure and shape.

3. *ANACOLIA ARISTIFOLIA* n. sp.

Plantae caespitosae vel laxae caespitosae, robustae. Caulis 6-12 cm. altus, supra flavo-viridis, in basi dense radiculosus, rufo-fuscus. Folia in sicco appressa, in humido patentia vel recurvata, lineari-aristata, ad basem ovata, 3.5-5 mm. longa, costae validae, perlonge excurrentiae, 1.5 mm. supra laminam.

Pedicellus capsulae innovando-lateralis, 6-8 mm. longus. Capsula erecta, globosa vel late ovalis, 2-2.5 mm. longa, subfusca, leptoderma, in sicco rugulosa. Dentibus 16, fragilibus.

Plants robust in dense yellowish-green tufts, 6-12 cm. high; stems branched and interwoven with dense felt-like reddish rhizoids; leaves appressed when dry, the tips somewhat divergent, open-erect to patent-recurved when moist, linear-aristate from an ovate base, 3.5-5 mm. long, the costa very long-excurrent, often extending 1.5 mm. beyond the lamina. Sporophyte as in the last species. Type locality, Vancouver Island. (Macoun, Can. Musci 17.) Type in the Canadian National Museum.

ILLUSTRATIONS:—*Pl. 68 H*, 16-17.

EXSICCATI:—Macoun, Can. Musci 17 (as *A. leiophylla*); Foster, Washington, no number.

On shaded rocks in woods, Washington and British Columbia.

The very slender leaves with the long-excurrent costa make this plant easy to recognize. It is related to *A. Menziesii* var. *Baueri* f. *grandifolia* in other respects. This plant is *A. leiophylla* Kindb., *nomen nudum* in part. Another specimen under this name is to be referred to the last species and another to *A. Baueri*.

4. *BREUTELIA* Schimp. Coroll. 85. 1856.

Plants robust, in dense tufts, yellowish; stems erect, branched, thick, tomentose below; leaves patent to squarrose, costa slender, percurrent or short-excurrent; lamina plicate or nearly flat, margin plane or narrowly revolute, finely serrate; cells linear, very narrow and strongly papillose to the base. Capsule

globose to ovoid, large, inclined; seta straight or curved; peristome double. Type species, *B. arcuata* (Dicks.) Schimp.

* BREUTELIA MOHRIANA (C. Muell.) Schimp. l. c.

Bartramia Mohriana C. Muell. Flora, 56: 482. 1873.

Philonotis Mohriana (C. Muell.) L. & J. Manual, 210. 1884.

Plants in dense or rather open tufts, large, yellowish-green, tomentose below; stems branched, 2-4 cm. high; leaves open-erect or patent, mostly 3 mm. long, lanceolate, slenderly acuminate; lamina slightly plicate; costa very slender, percurrent or excurrent to a very slender subula; margins very narrowly revolute, finely serrulate above, denticulate below; cells linear, strongly papillose, 4-7 μ wide, uniform to the base, rather opaque, the extreme basal cells shorter, rectangular, slightly broader. Dioicous; perigonium discoid, bright yellowish-brown, bracts ovate at the base, concave; seta 1.5-2 cm. long, flexuose; capsules inclined or cernuous, 2-2.5 mm. long, ovoid, unsymmetric, gibbous above, with mouth oblique, furrowed when dry; peristome double as in *Philonotis*. Type locality, Louisiana. A rare plant and apparently restricted to Louisiana.

ILLUSTRATIONS:—Pl. 68 D.

EXSICCATI:—Mohr, Louisiana.

A very distinct plant in all respects and not likely to be confused with anything else.

5. PLAGIOPUS Brid. Bryol. Univ. 1: 596. pl. 5. 1826.

Bartramia, subgenus *Oreadella* C. Muell. Syn. 1: 508. 1849.

Plants in dense tufts similar to *Bartramia*; stems branched, 3-angled in cross-section with a loose thin-walled cortical layer of cells. Type species, *P. serratus* Brid. l. c.

PLAGIOPUS OEDERI [Gunn.] Limpr. Laubm. 2: 548. 1893.

Bartramia Oederiana Sw., Schrad. Bot. Journ. 2: 181. pl. 2B f. 5. 1800.

Bartramia Oederi Brid. Musc. Recent 2³: 136. pl. 2, f. 9. 1803 (according to Braithwaite).

Bartramia longiseta Brid. Musc. Recent. 2³: 136. pl. 2, f. 10. 1803 (not of Richard, 1803).

Bartramia subintegriifolia P. B. Prodr. 44. 1805.

Bartramia Oederi Schwaegr. Suppl. 1²: 49. pl. 59. 1816.

Plants in very dense tufts, green above, brownish below with numerous interwoven papillose rhizoids; stems branched, 3-9 cm. high, 3-angled in cross-section with a loose, thin-walled layer of cells on the outside; leaves dense, more or less twisted when dry, recurved when moist, 3-4.5 mm. long, linear-lanceolate to lanceolate; costa stout, percurrent or shortly excurrent, toothed at the back; margins widely recurved, coarsely serrate above and on the adjacent cells of the lamina, entire or dentate below; upper cells oblong, 6-8 μ wide, chlorophyllose; basal cells linear, about the same width, all smooth except the marginal ones toothed or low-papillose. Synoicous; seta straight, 1-1.5 cm. long; capsule erect or slightly inclined, globose to ovoid, 1-1.7 mm. long, furrowed when dry, mouth small; lid small and low-conic; peristome double, segments and cilia well developed; spores globose to reniform, warty, 16-20 μ in diameter. Type locality, European.

ILLUSTRATIONS:—Bry. Eur. pl. 318; Husnot, Musc. Gall. pl. 73; Limpr. Laubm. 2: 549, f. 312; Grout, Mosses with a H-lens (Ed. 3) figs. 55, 56; Pl. 67 G.

EXSICCATI:—Drumm. Musc. Am. 240 (as *Bartramia gracilis*). Sull. Musc. Allegh. 121 (in part, as *Bartramia pomiformis*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 172, (Ed. 2) 258; Aust. Musc. Appal. 222; Holzinger, Musc. Acro. Bor. Am. 164; Grout, Musci Perfecti 41.

On moist soil and rocks, usually in mountains or shaded ravines, seemingly prefers calcareous regions. Widely distributed, Labrador to Alaska, south to Washington, Colorado, Michigan, Illinois and Pennsylvania.

The 3-angled stems, short smooth leaves, inflated cortical cells, small capsule and slender habit make this species easily recognizable.

6. BARTRAMIA Hedw. Stirp. Crypt. 2: 111. pl. 40. 1789; Sp. Musc. 164. 1801.

Plants erect in dense or loose tufts, 2-12 cm. high, bright green, yellowish-green or glaucous; stems branched, not whorled, with outer layer of small cells and central strand prominent; leaves linear or sub-

late, serrate, costa percurrent or excurrent; upper cells quadrate to linear, basal cells enlarged, all papillose at the ends of the lumen. Dioicous, autoicous or synoicous; perigonia gemmiform; setae variable, very short to long; capsules globose to ovoid, longitudinally furrowed when dry, 1-2 mm. long; peristome double, single, or lacking; cilia, when present, poorly developed; inner peristome often much reduced or lacking; spores reniform to globose, papillose. Type species, *B. Halleriana*.

A distinctive genus which formerly included most of the other genera of the family. It may be subdivided into three sections or subgenera as follows:

VAGINELLA, characterized by the leaves having a hyaline sheathing base with an abruptly narrowed and divergent subula, the costa spreading in the subula and apparently occupying the entire width. It includes *BB. ithyphylla*, *viridissima*, *breviseta*, *microstoma* and *glauca*.

STRICTIDIDIUM, characterized by the strict habit with lanceolate-aristate leaves, not sheathing, capsules erect and a distinct costa. *B. stricta* is our only representative.

EUBARTRAMIA, characterized by tall loose tufts, large linear leaves with shorter cells, base not strongly differentiated, costa distinct and margins revolute. It includes *BB. pomiformis*, *Halleriana*, *glauco-viridis* and *circinulata*.

KEY.

1. Leaves large, linear, 4-7 mm. long, not strict, base not sharply differentiated; plants large, up to 10 cm. high..... 2.
- Leaves smaller, subulate, abruptly narrowed and divergent from a hyaline sheathing base (except *B. stricta*), strict, 2.5-5 mm. long; plants small, strict, up to 5 cm. high..... 6.
2. Seta short, equaling the immersed capsules or slightly longer..... 1. *Halleriana*.
- Seta far exceeding the length of the capsules..... 3.
3. Leaf margins bordered, bistratose..... 4.
- Leaf margins not bordered, single stratose except for the teeth..... 5.
4. Leaves close, base not sheathing, patent to spreading, usually not crisped when dry. 2. *pomiformis*.
- Leaves distant, base broader and somewhat sheathing, abruptly recurved, crisped when dry..... 2a. var. *crispa*.
5. Leaves dense, patent, incurved but not crisped when dry, glaucous green..... 3. *glauco-viridis*.
- Leaves distant, widely recurved to circinate, strongly crisped when dry..... 4. *circinulata*.
6. Leaf base not sheathing nor abruptly differentiated; costa uniformly slender to the apex..... 10. *stricta*.
- Leaf base hyaline and sheathing; costa spreading in the subula and apparently occupying the entire width..... 7.
7. Leaf base oblong, 1 mm. long or more..... 8.
- Leaf base obovate to shortly oblong, mostly 0.7 mm. long..... 10.
8. Margins finely serrate; cells of teeth and lamina linear; capsules cernuous, 1.5-2.5 mm. long; peristome double..... 5. *ithyphylla*.
- Margins coarsely serrate; cells of teeth and lamina oblong; capsules erect or inclined, 1-1.5 mm. long; peristome single or lacking..... 9.
9. Capsules erect, globose to ovoid, mouth large, spores 26-30 μ 6. *Viridissima*.
- Capsules erect or inclined, mouth small; seta often arcuate; spores 30-42 μ 8. *microstoma*.
10. Leaf margins finely serrate; cells of the teeth and lamina oblong to linear; capsules erect or inclined, seta 1 cm. long or less..... 7. *breviseta*.
- Leaf margins coarsely and bluntly serrate; cells of the teeth much larger than those of the lamina; lower leaves much shorter; capsules cernuous; seta 1 cm. long or longer..... 9. *glauca*.

1. BARTRAMIA HALLERIANA Hedw. l. c.

Bartramia norvegica [Gunn.] Lindb. Öfv. Vet.-Akad. Förh. 20: 389. 1863.

Plants in tall loose tufts, 4-12 cm. high, green or yellowish-green; stems branched; leaves curled and crisped when dry, spreading to recurved when moist, *distantly disposed*, *linear-subulate*, *abruptly narrowed from a broad subclasping base*, 6-7 mm. long; costa slender but strong, prominent and toothed at the back,

excurrent to a very spinulose arista; margins *revolute nearly to the apex*, strongly and doubly serrate above; upper cells small, elliptic to oval or oblong, 4–6 μ wide, papillose on both faces; basal cells linear to oblong, 6–9 μ wide, broader toward the margin. Autoicous or synoicous; perigonium very slender and borne just below the perichaetium; leaves shorter, the base more strongly sheathing, antheridia few; perichaetium lateral by innovation; *seta short, equaling or slightly longer than the capsule; capsules globose, 2.5 mm. long, reddish-brown, furrowed when dry, at first exceeding the stems but later appearing lateral and far below the stem tips*, immersed, often two or three capsules from the same perichaetium; peristome double, teeth lanceolate, strongly barred, 0.5 mm. long, reddish-brown; segments keeled, yellowish, longitudinally papillose in lines; cilia very slender; lid flatly convex; spores reniform, papillose, 22–25 μ . Type locality, Switzerland.

ILLUSTRATIONS:—Braithw. Brit. Moss Fl. 2: pl. 76D; Husnot, Musc. Gall. pl. 74; Bry. Eur. pl. 320; Monkemeyer, Laubm. Eur. 578, fig. 119d; Dixon & Jam. Handb. Brit. Mosses (Ed. 3) pl. 39B; Pl. 68C.

EXSICCATI:—Drumm. Musc. Am. 239.

Rare in North America, with a few collections recorded from the Rocky Mountains, Portage River.

According to Limpricht this plant favors regions free of calcium. It is apparently a plant of acid soil and humus in shaded places. The tall stems with distant spreading or recurved leaves and numerous sub-lateral capsules make its recognition easy. Sterile plants are scarcely to be separated from other large species of the genus, although the long leaf base with the abruptly narrowed upper portion is quite striking.

2. BARTRAMIA POMIFORMIS [L.] Hedw. Sp. Musc. 164. 1801.

Plants in dense or loose tufts, 2–8 cm. high, very soft, green or yellowish-green, often glaucous, densely tomentose below with brown papillose rhizoids; stems erect, branched, leaves flexuose or crisped when dry, patent to spreading when moist, *rather densely disposed*, narrowly lanceolate to linear-lanceolate, canaliculate, diverging from an ovate or oblong base, 5–6 mm. long, insertion plane or only slightly clasping; costa stout, prominent at the back and strongly spinulose above, excurrent to a very spinulose point, which is terete; *margins revolute to the apex, bistratose above* and doubly serrate with large and strongly thickened cells, on both the margin and the recurved surface; upper cells of the lamina oblong, elliptical or subquadrate, mostly 7 μ wide, papillose on both sides; basal cells linear to oblong, papillose on both ends, marginal ones becoming shorter and broader. Autoicous or synoicous; perigonia borne next to the perichaetium, both lateral by innovation; bracts broadly ovate at the base and sheathing; seta 1–2 cm. long, sometimes shorter; capsule mostly exserted above the stem tips, inclined or cernuous, globose to ovoid, deeply furrowed when dry, reddish to dark chestnut-brown, about 1.5 mm. long; lid low-convex; peristome double, teeth lanceolate, about 0.4 mm. long, reddish to reddish-brown; basal membrane high, segments pale yellowish, keeled, shorter than the teeth; cilia poorly developed; spores spherical to reniform, papillose, 20–26 μ . Type locality, European.

ILLUSTRATIONS:—Bry. Eur. pl. 310; Braithw. Brit. Moss Fl. 2: pl. 76C; Husnot, Musc. Gal.. pl. 73; M. H. M. pl. 44; Jennings, Mosses W. Pennsylvania, pl. 24.

EXSICCATI:—Sull. Musc. Allegh. 122; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 171, (Ed. 2) 257; Aust. Musc. Appal. 221; R. & C. Musc. Am. Sept. 53; Holz. Musc. Acro. Bor. Am. 41; Grout, Musci Perfecti 87; Steere, Michigan Bryophytes 209; Allen Mosses Cascade Mts. 51.

Widely distributed on moist shaded soil and in moist crevices of rocks; Nova Scotia to Florida, west to Colorado, Oregon and British Columbia.

This is the commonest species of *Bartramia* and is quite variable in size and aspect. It grows mostly in woods and shaded ravines, in canyons and in cliffs, bordering rivulets and on swampy ground. In these various habitats it assumes slightly different habits, often very short with closely disposed leaves that are very crisped when dry, dark or glaucous green; the seta often less than 1 mm. long. In open woods and on higher and drier ground it becomes open tufted, the leaves less crisped and the seta longer. When fresh and ripe the capsules are globose but after drying they frequently do not return to the full rotundity they originally had. The bordered leaves make the identification of this species easy in whatever habit form it may occur. Crisp forms grade into the variety and larger plants often resemble *B. Halleriana* and the two are so much alike in vegetative character that they may be confused unless the fruit is present.

2a. Var. CRISPA Bry. Eur. fasc. 12. pl. 310. 1842.

Bartramia crispa Sw. Disp. Musc. Suec. 73. 1799; Brid. Bryol. Univ. 2: 41. 1827.

Plants large, tufts open and rather lax; *leaves distantly disposed, widely spreading or recurved*, 5–6 mm. long, narrower than those of the species, the base more distinctly differentiated, subclasping, the upper portion

more abruptly divergent, when dry strongly crisped; capsule usually not surpassing the stem tips. Type locality European.

EXSICCATI:—Drumm. Musc. Am. 237; Holz. Musc. Acro. Bor. Am. 580; Can. Crypt. 2708; Svihla 704.

Widely distributed but it seems to be more abundant northward. North Carolina, Illinois, New Brunswick, Minnesota, Washington and British Columbia.

This plant resembles both *B. Halleriana* and *B. circinulata*. The plumose stems are tall and the widely recurved leaves give it a striking appearance. The bordered leaves definitely associate it with the species.

3. *BARTRAMIA GLAUCO-VIRIDIS* C. M. & Kindb. Macoun, Cat.

Can. Pl. 6: 105. 1892.

Plants large and loosely tufted, glaucous to yellowish-green; stems branched, 4–8 cm. high; leaves somewhat crisped when dry, mostly patent and incurved when moist, linear from a half-sheathing base, abruptly divergent, 6–8 mm. long; costa shortly excurrent, spinulose; margins revolute to above middle, strongly serrate but not bordered. Cells and sporophyte as in *B. pomiformis*. Type locality, Revelstoke, B. C.

ILLUSTRATIONS:—Pl. 68 A.

EXSICCATI:—Macoun, Can. Musci 44, 81 & 157; Fl. Can. 681; Holz. Musc. Acro. Bor. Am. 163.

On damp soil. Apparently limited to the Pacific northwest, Washington and British Columbia.

This species has much the same appearance as *B. pomiformis* but the leaves are unbordered, narrower above and the costa somewhat longer excurrent. The glaucous green color is predominant but related forms have the same appearance.

4. *BARTRAMIA CIRCINULATA* C. M. & Kindb., Macoun, Cat. Can. Pl. 6: 105. 1892.

Resembling *B. pomiformis* var. *crispa* in habit and appearance, large and loosely tufted; leaves strongly crisped when dry, very widely disposed and strongly recurved to subcircinate when moist; base half-sheathing, upper portion abruptly recurved or divergent, linear; costa excurrent to a slender spinulose apex; margins widely revolute in the lower half, coarsely serrate above with teeth on some of the adjacent cells, not bordered; upper cells rectangular to quadrate, some transversely elongated, becoming longer and narrower toward the margin; basal cells longer, oblong to linear; sporophyte as in *B. pomiformis*. Type locality, British Columbia.

ILLUSTRATIONS:—Pl. 68 B.

EXSICCATI:—Macoun, Canadian Musci 6; Can. Nat. Museum 108.

On damp soil in shade. It seems to be limited to the Pacific northwest.

The much curled and crisped character when dry is striking. The unbordered leaves, widely disposed and with longer-excurrent costae separates it from related forms. The recurved leaves of *B. pomiformis* var. *crispa* do not reach the same degree of curvature as in this species.

5. *BARTRAMIA ITHYPHYLLA* Brid. Musc. Rec. 2^o: 132. 1803; Bryol. Univ. 2: 43. 1827.

Plants in dense tufts, soft, green or glaucous-green; stems erect, fastigately branched, brownish tomentose below, 2–4 cm. high; leaves dense, slightly appressed when dry, divergent and patent when moist, 4–5 mm. long, lanceolate-subulate, abruptly narrowed and divergent from an oblong clasping base; costa wide in the base and spreading in the upper portion, apparently occupying almost the entire width of the lamina, indistinct, excurrent to a short sharp point, in cross-section crescent-shaped, bi- or tri-stratose except at the edges, median guides extending about two-thirds the width; margins plane, finely serrate; upper cells linear to oblong, 4–6 μ wide, chlorophyllose, becoming shorter and broader at the shoulders and more distinct; basal cells clear, hyaline, linear to oblong, 7–10 μ wide, 60–100 μ long, thin-walled, becoming abruptly colored or chlorophyllose at the shoulders. Synoicous; perichaetial leaves 4.5–6 mm. long, costa longer excurrent, base more clasping; seta lateral by innovation, 1.3–2 cm. long; capsule globose to ovoid, 1.5–2.5 mm. long, inclined or cernuous, slightly unsymmetric, furrowed when dry; lid convex, obtuse or with a very blunt point which is often turned upward; peristome double, teeth lanceolate, 0.3 mm. long, strongly barred, finely papillose above, coarser toward the base, reddish-brown; segments from a basal membrane, shorter than the teeth, often irregular, yellowish; cilia short; spores large, 27–36 μ , reniform, warty, brown. Type locality European.

ILLUSTRATIONS:—Braithw. Brit. Moss Fl. 2: pl. 76E; Limpr. Laubm. 540, fig. 311; Husnot, Musc. Gall. pl. 73; Bry. Eur. pl. 317; Monkemeyer, Laubm. Eur. 578, fig. 119a; Dixon & Jam. Handb. Brit. Mosses, (Ed. 3) pl. 38H; Pl. 67 H.

EXSICCATI:—Drumm. Musc. Am. 238; Holz. Musc. Acro. Bor. Am. 243; Svihla 1047; Sullv. & Lesq. Musc. Bor. Am. (Ed. 1) 170; Foster 1028; Leiberg 50.

Widely distributed in the northern part of North America and following the mountain ranges southward. Pennsylvania, New Hampshire, New Brunswick, Labrador, Greenland, Alaska, British Columbia, Washington, California, Arizona, and Colorado. On damp soil and in crevices, usually in deep, shaded places.

This plant forms the center of a number of related species from which it is very easily distinguished by the inclined or cernuous capsule. The vegetative characters are much the same in gross aspect but vary in the more minute details. The leaf base is rather long and generally exceeds 1 mm.; usually being very white and shiny, but older plants have the base somewhat colored. The upper portion is generally narrower than in related forms, with the exception of *B. breviseta*; the marginal teeth are composed of linear cells so that the projections forming the teeth are quite distant from one another. In most cases *B. viridissima*, *B. glauca* and *B. microstoma* have very closely and coarsely serrate leaves. *B. glauca* and *B. breviseta* have a much shorter leaf base, usually less than 1 mm. long. *B. ithyphylla* is the only species with a well developed double peristome; in the remainder the teeth are in a single row, the inner peristome degenerate or lacking. Frequently the teeth are degenerate, especially in species with erect capsules.

5a. Var. STRIGOSA (Wahl.) C. Hartm. Handb. Skand. Fl. (Ed. 10) 2: 48. 1871.

Bartramia pomiformis var. *strigosa* Wahl. Fl. Lapp. 362. 1812.

B. strigosa Hartm. Vet.-Akad. Handl. 1814: 102. 1814.

B. stricta Hartm. Handb. Skand. Fl. (Ed. 3) 2: 291. 1838. (Non Bridel 1803.)

B. ithyphylla var. *rigidula* Schimp. Syn. (Ed. 2) 510. 1876.

B. ithyphylla subsp. *rigidula* Kindb. Eur. & N. A. Bryin. 323. 1897.

Leaves shorter, erect and strict, very stiff and brittle, the tips often broken, Type locality European.

EXSICCATI:—Coville & Kearney 2181, Brewer & Coe 681.

Six collections of this variety are reported from Alaska.

Var. FRAGILIFOLIA Card. & Thér. Bot. Gaz. 37: 369. 1904. Bryologist. 8: 71. 1905.

Differs from the type in its rigid, fragile, much broken leaves.

Colorado: Along the Cogwheel Railroad to Pikes Peak, alt. 2100–2000 m. (J. M. Holzinger, 1896).

I saw only a few scraps of this plant which impressed me as being nothing more than a depauperate specimen of the species. The description fits the former variety and the plant, excepting the patent leaves, might be placed there.

6. BARTRAMIA VIRIDISSIMA (Brid.) Kindb. Eur. & N. Am. Bryin. 323. 1897.

Weisia viridissima Brid. Bryol. Univ. 1: 364. 1826.

Bartramia subulata Bry. Eur. fasc. 31. pl. 315. 1846.

Bartramia ithyphylla var. *subulata* Husnot, Musc. Gall. 266. 1890.

Plants in short dense tufts having the appearance of small form of *B. ithyphylla*; stems erect, branched, 1–3 cm. high with few smooth rhizoids; leaves strict and brittle, the tips often broken, somewhat appressed when dry, erecto-patent when moist, lanceolate-subulate, concave, abruptly narrowed and divergent from an obovate-oblong half-clasping base, 3–4 mm. long; base 0.8–1.2 mm. long, hyaline or slightly colored, not shiny; costa wide, expanding in the divergent upper portion and apparently occupying most of the lamina, crescent-shaped in cross-section, bi- tri-stratose except for two or three rows of cells at the margin, median guides occupying about two-thirds of the width; margins plane, finely or rather coarsely serrate above, cells of the teeth larger than those of the lamina; upper cells opaque and chlorophyllose, oblong to linear, 4–6 μ wide, papillose with rounded papillae; cells of the shoulders oblong to quadrate; basal cells larger, linear to oblong, 10–12 μ wide, clear and hyaline, thin-walled, Autoicous or synoicous; seta 1–2 cm. long; capsule globose, erect, 1–1.5 mm. long, furrowed when dry; peristome single, teeth 0.2 mm. long or shorter, slenderly lanceolate, often irregular, fragile and sometimes lacking; lid conic, obtuse; spores reniform, warty, 26–30 μ . Type locality European.

ILLUSTRATIONS:—*Pl. 68 E.*

EXSICCATI:—Holzinger, Colorado, no number.

On rather damp ground, often in places that soon become early dried up. In North America the plant seems to be restricted to the Rocky Mountains, Arizona, Colorado, Idaho to Alaska.

This plant is related to *B. ithyphylla* and *B. breviseta*. From the former it differs in the shorter leaves, more coarsely serrate margins, the erect capsule with single peristome and the more rigid and brittle character. From the latter it differs in the longer leaf base, smooth rhizoids and smaller spores. It is also closely related to *B. glauca*, which has shorter leaves on the lower portion of the stems, more coarsely serrate margins and shorter base. *Microstoma* has a much smaller capsule mouth, larger spores and a shorter seta.

7. *BARTRAMIA BREVISETA* Lindb. Not. Sällsk pro Fauna et Flora Fenn. 9: 255. 1868.

Bartramia ithyphylla var. *breviseta* (Lindb.) Husnot, Musc. Gall. 266. 1890.

B. ithyphylla var. *breviseta* (Lindb.) Kindb. Arten d. Laubm. Schwed. und Norw. 153 ex p. 1883.

Much like *B. viridissima* in appearance. Tufts short and dense, 2–3 cm. high, rhizoids numerous, reddish-brown, the larger ones papillose; stems branched, erect and rather strict; leaves slightly appressed when dry, brittle, the tip often broken, erecto-patent to patent when moist, lanceolate-subulate, abruptly narrowed and divergent from an obovate-oblong clasping base, 3.5–4 mm. long (the base 0.5–0.8 mm. long); costa broad in the clear hyaline base, expanding at the shoulders and apparently occupying most of the lamina, which is crescent-shaped in cross-section, bi-tri-stratose except at the margin; median guides occupying about half the width; margins plane, two or three rows of cells unistratose; finely serrate above, cells of the teeth linear to rhomboidal; cells of the lamina linear to oblong, 4–7 μ wide, papillose; basal cells larger and thin-walled, hyaline, 10–14 μ wide; cells of the shoulders oblong to quadrate, unistratose area diminishing up the margins. Synoicous; seta 0.7–2 cm. long; capsule globose to ovoid, erect, shortly emergent or exerted above the stem tips, striate when dry, 1.4–2 mm. long, mouth rather wide; peristome single, teeth short, 0.2 mm. long or shorter, very irregular and often lacerate or perforated, finely striate below, often irregularly thickened, sometimes entirely lacking; lid low-convex, obtuse or bluntly pointed; spores globose to reniform, large, 30–41 μ , warty. Type locality, Norway.

ILLUSTRATIONS:—Engler & Prantl (Ed. 2) 10: 397. f. 397a–f; *Pl. 67 I.*

EXSICCATI:—Macoun, Can. Musci 204, 248; Frye, no number.

This plant has been collected by Frye and Macoun in Alaska, and apparently is limited to the northern regions.

According to the Barnes and Heald key and also Limpricht, the seta is required to be very short and immersed below the stem tips but this was found in only two capsules of all the specimens examined. All the rest were shortly exerted or emergent. In the Barnes and Heald key the basal cells are said to be shorter towards the margin, a character that could not be demonstrated in any of the specimens in hand. Prof. Holzinger states (Publ. Puget Sound Biol. Sta. 3: 28, 47) that there are no clearly defined guides but I find that they are evident, at least in the broader portion of the subulate apex of the leaves. Limpricht agrees on this point, but calls for small conduction groups with stereids. The latter were not observed in the Alaskan plants.

The plant differs from *B. viridissima* in having a shorter leaf base, abundant papillose rhizoids and larger spores. It is also less strict and brittle and more finely and distantly serrate. *B. glauca* agrees in the short leaf base but the margins are very coarsely and closely serrate and the lower leaves are shorter.

Many authorities have treated this plant as a variety of *B. ithyphylla* but the erect capsule with the poorly developed peristome, shorter seta and shorter leaf base clearly mark it as distinct.

8. *BARTRAMIA MICROSTOMA* Mitt. Jour. Linn. Soc. 12: 272. 1869.

Plants much like *B. viridissima*. Stems erect, branched, 2–4 cm. high, bright green above, brownish below, rhizoids few, smooth; leaves 3–5 mm. long, base hyaline and sheathing, about 1 mm. long; costa wide and indistinct; subula coarsely serrate; cells oblong to linear, strongly papillose. Seta short, 0.8–1 cm. long, straight or arcuate; capsules ovoid, 1.5–2 mm. long, tapering at the base with a short but distinct neck, mouth small, 0.4–0.5 mm. in diameter; peristome single or with a very shallow membrane representing the inner peristome; teeth lanceolate, linear or oblong, often irregular with prominent joints, finely longitudinally striate, reddish-brown; spores large, 30–42 μ , warty, dark reddish-brown. Type locality, Guatemala (Godman & Salvin).

ILLUSTRATIONS:—*Pl. 67 J.*

EXSICCATI:—Bartram, Mosses S. Arizona 154; Holz. Musc. Acro. Bor. Am. 579.

Specimens from the mountains of Southern Arizona collected by Mr. Bartram represent the only station for this plant north of Mexico. The gametophyte characters are so close to those of *B. viridissima* that a

separation on that basis would be difficult. The arcuate seta is not mentioned in the original description. The small capsule with short neck, small mouth and large spores makes it easily separated from other plants. *B. breviseta* has spores of similar size but the short leaf base, finely serrate margins and larger capsules with larger mouth make that plant distinct.

9. BARTRAMIA GLAUCA Lorentz, Moosst. 160. 1864.

Much like *B. ithyphylla* but tufts more laxly coherent, 2-4 cm. high, glaucous green, rhizoids smooth; upper leaves large and the subula broader at the shoulders, lower leaves shorter, 2-3 mm. long, base obovate to rectangular, 0.4-0.7 mm. long; margin of the subula coarsely and closely serrate with blunt teeth; cells of the teeth much larger than the adjacent cells of the lamina, 8-12 μ wide, rhomboidal to oblong; upper cells near the margin oblong to rectangular, strongly papillose; tips of the subula fragile, often broken. Seta 2.2 cm. long; capsule cernuous, 1.6 mm. long, furrowed when dry; peristome not seen. Type locality, Mexico. Habitat and collector not known.

ILLUSTRATIONS:—Pl. 68 F.

EXSICCATI:—Bartram, Mosses S. Arizona 1265.

Mr. Bartram collected this plant in the Santa Rita mountains of Arizona and it apparently marks the northern limit of the species. The original description states "flowers and fruit unknown." A single plant in the herbarium of the New York Botanical Garden had one old capsule (shown in the dry condition in the illustration). The peristome was lacking or perhaps broken and no microscopic observation was made. The shorter lower leaves, short base, and coarsely serrate margin of the subula are the main points distinguishing it from other species.

10. BARTRAMIA STRICTA Brid. Musc. Rec. 2³: 132. pl. 1, f. 5. 1803.

Bartramia strictifolia Taylor, Lond. Journ. Bot. 54. 1846.

Plants erect in dense tufts, 1-3 cm. high, bright green above, brownish and tomentose below; stems branched; leaves erecto-patent, strict, appressed when dry, brittle, narrowly lanceolate, with apex slender, 2.5-3.5 mm. long; upper ones more slender, linear-lanceolate, lower shorter; costa narrow, excurrent to a slender arista, prominent at the back; margin narrowly revolute near the base, finely serrulate above; upper cells linear, strongly papillose, 4-6 μ wide, becoming shorter and broader toward the base, oblong to rectangular, 7-10 μ wide, smooth or faintly papillose, rather thin-walled but not hyaline; insertion plane, not clasping. Synoicous; seta straight, 1-1.5 cm. long; capsules erect, ovoid, small, 1.4-2 mm. long, narrowly sulcate when dry; lid low convex; peristome single, teeth lanceolate, about 0.2 mm. long, arising several joints below the mouth, finely papillose in lines above, coarser below; spores reniform, warty, 26-30 μ in diameter. Type locality, Africa.

ILLUSTRATIONS:—Brid. l. c.; Braithw. Brit. Moss Fl. 2: pl. 77A; Pl. 67K.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 244; Leiberg 1687; Allen, no number.

On moist soil and in crevices chiefly in mountains. Colorado, Montana, Idaho, California and probably throughout the Rocky Mountains, Sierra Nevada and Cascade Ranges.

The strict habit, non-clasping leaves with plane insertion and distinct slender costa distinguish this plant. Superficially it resembles the *B. viridissima* group.

7. BARTRAMIDULA Schimp. Bryol. Eur. fasc. 29/30. 1846.

Plants loosely tufted; stems erect or ascending, with outer layer of cells loose, about 1 cm. long; branching whorled; leaves ovate- to triangular-lanceolate, erect to patent, not plicate; costa disappearing or percurrent; upper cells oblong to linear, papillose, basal cells oblong, broader and thin-walled, Synoicous; seta 0.8-1.6 cm. long; capsule small, not furrowed when dry but minutely rugulose, tapering to the seta, mouth small; peristome lacking; spores reniform. Type species, *B. Wilsoni*.

BARTRAMIDULA CAROLINAE Sharp, n. sp.

Plantae minutae, circa 1 cm. longae; folia triangula-lanceolata, 0.6-1 mm. longa, costa evanida vel percurrente.

Plants very small, in loose tufts, bright or glaucous green; rhizoids not dense, smooth; stems erect or ascending, whorled, very slender, about 1 cm. long; leaves appressed when dry, erect to patent when moist, triangular-lanceolate, 0.6-1 mm. long; costa disappearing in the apex or percurrent; margin plane, serrate above, dentate below; upper cells oblong to linear, 4-7 μ wide, papillose at one or both ends, basal cells

oblong, 7–11 μ wide. Synoicous; perichaetium subtended by 1–3 whorled innovations; leaves oblong-lanceolate, 1.2 mm. long, oblong base subsheathing; costa very narrow, basal cells enlarged, thin-walled and inflated; seta very slender, flexuose, 8–16 mm. long, reddish and shiny; capsule small, erect, ovoid to subglobose, tapering to the seta with a very short neck, thin and membranaceous, 1.5 mm. long, not furrowed but minutely rugulose when dry; mouth small, 0.4–0.5 mm. in diameter; lid low-convex; peristome lacking; spores reniform, papillose, 32–36 μ in diameter. Type locality, Bridal Veil Falls, Highlands, North Carolina, 3500 feet (Sharp). On the face of wet gneiss cliff.

ILLUSTRATIONS:—Pl. 67 D.

EXSICCATI:—Sharp 341058.

This little plant was discovered by A. J. Sharp and is the first definite record of *Bartramidula* in the United States. *B. mexicana* of Mexico is the closest relative in North America. The very small size, very slender habit, erect capsule not furrowed when dry but minutely rugulose, together with the small naked mouth and synoicous disposition of the reproductive organs make it a splendid new species.

8. PHILONOTIS Brid. Bryol. Univ. 2: 15. 1827.

Bartramia of authors, in part.

Plants usually densely tufted, interwoven with dense tomentum below; stems erect or ascending, varying from short slender plants less than 1 cm. high to tall robust forms reaching 10 cm. high; branches whorled and subtending the perigonia or irregularly branched and sterile; leaves 5–many-ranked, appressed when dry, erecto-patent to patent when moist, narrowly lanceolate to broadly ovate, usually narrowly acuminate, 0.5–3.5 mm. long; costa percurrent to long-excurrent; margins plane or revolute, singly or doubly serrate; upper cells linear to oblong, papillose at one or both ends, basal cells usually enlarged and thin-walled. Dioicous, autoicous or polygamous; perigonia gemmiform or discoid, bracts broadly ovate and sheathing at the base, abruptly narrowed above, costa usually faint and disappearing. Seta long; capsules subglobose to ovoid, strongly inclined or cernuous, longitudinally furrowed when dry; peristome double, teeth 16, strongly barred, the upper joints with ovoid or globose thickenings; segments from a high basal membrane, cilia present (poorly developed in *Ph. Muhlenbergii*); spores reniform to globose, papillose. Type species, *Philonotis fontana*.

Water-loving mosses, growing on stream banks, around springs, in wet meadows, dripping cliffs and banks, under snow banks and on shores of lakes and ponds.

The genus is divided into two subgenera as follows:

PHILONOTULA C. M., including *P. glaucescens*, *P. gracillima*, *P. sphaerocarpa*, *P. uncinata* and *P. longiseta*.

EUPHILONOTIS Limpr. Laubm. 2: 557. 1893, including *P. marchica*, *P. Muhlenbergii*, *P. capillaris*, *P. fontana*, *P. americana*, *P. caespitosa* and *P. calcarea*.

Polymorphism in the Euphilonotis group is marked and the intergrading forms are endless. Normally the main stems of sterile and female plants have larger and broader leaves than the male stems and whorled innovations and are to be considered as typical. In all cases of diagnosis they should be taken from that portion of the stem between the middle and upper fourth as the descriptions apply to these leaves unless otherwise stated. The comal leaves are nearly always larger and with longer points while the basal leaves are often very much shorter with blunt points and the costa ending below the apex. The leaves of the male stems are usually smaller, narrower and closely appressed. The leaves of the whorled innovations are smaller and narrower.

Foliar dimorphism is evident in nearly all plants but in plants of extreme aquatic, alpine and arctic habitats this condition is often accentuated to such an extent as to give the plants an entirely different appearance when compared with the typical form. Parallel varieties and forms exist in the several species. Lax varieties are common and occur in several forms. Usually the stems are long and weak, the leaves distant, spreading or loosely appressed and lying parallel with the stem. Some forms show typical leaves at the apex of the stem while the larger portion of the lower stem is clothed with lax, concave and appressed leaves having blunt points, a large area of lax cells and the costa ending in or below the apex. These forms have been designated *dimorphophylla*. In some plants the reverse condition is manifested, the shorter bluntly pointed leaves occurring near the apex of the stems with normal leaves below. These forms are designated *heterophylla*.

Plants having leaves with extremely long and slender excurrent costae are to be related to species established by other predominating characters. Many plants have the upper leaves more or less falcate and represent minor forms.

* The parallel between *Philonotis* and *Drepanocladus* in these respects is very striking.—A. J. G.

Sterile plants, particularly among the *Philonotulae*, often show propagula or brood stems in the axils of the leaves. These structures consist of very small deciduous stems with tiny leaves at the tips. They are often abundant. Brood stems have been found in nearly all the species of *Euphilonotis* but generally they persist until they are larger and similar to the main stems. They fall easily, however, and may be identified as brood stems by the characteristic abscission cells at the base which are inflated and colored.

KEY TO THE SPECIES AND VARIETIES AND SOME FORMS.

- Perigonia gemmiform, plants dioicous, autoicous or polygamous..... PHILONOTULA.
Perigonia discoid, plants dioicous..... EUPHILONOTIS.

PHILONOTULA.

1. Autoicous or polygamous..... 2.
Dioicous..... 4.
2. Autoicous, perigonial bracts broad and clasping at the base or plants sterile..... 3.
Polygamous, bracts not very broad, only half sheathing..... 5b. f. *polygama*.
3. Stems and leaves uniform..... 5. *longiseta*.
Stems rather abruptly and slenderly prolonged with much reduced leaves bearing numerous brood bodies in the axils, sterile..... 5a. f. *propagulicaulis*.
4. Leaves oblong-lanceolate to slenderly triangular-lanceolate; cells oblong to linear..... 5.
Leaves small, ovate-acute to ovate-lanceolate; cells oblong or shorter..... 10.
5. Stems hooked at the tips; upper leaves falcate; costa of the perigonial bracts long spinulose-excurrent..... 4. *uncinata*.
Stems not hooked; costa of the perigonial bracts percurrent or ending below the apex..... 6.
6. Leaves oblong lanceolate, subfalcate, 0.4-0.8 mm. long; margins plane or slightly recurved, bluntly dentate..... 7.
Leaves triangular-lanceolate, straight, margins narrowly revolute, sharply serrate; costa slender, shortly or longly spinulose-excurrent..... 9.
7. Leaves acute or acuminate; costa percurrent or shortly excurrent..... 8.
Leaves obtuse; costa ending below the apex..... 2. *gracillima*.
8. Cells firm, linear-oblong..... 1. *glaucescens*.
Cells large and very lax, oblong, hyaline..... 1a. forma *laxa*.
9. Leaves 1-2 mm. long, green..... 3. *sphaericarpa*.
Leaves 0.4-0.7 mm. long, pale..... 3a. var. *terrestris*.
10. Leaves 0.8-1 mm. long..... 1b. var. *terrestris*.
Leaves 0.4-0.7 mm. long, ovate..... 1c. var. *brevifolia*.

EUPHILONOTIS.

1. Leaf cells papillose at the upper ends..... 2.
Leaf cells papillose at the lower ends, rarely at the upper or both ends..... 4.
2. Leaves triangular-lanceolate to ovate-lanceolate; cells linear; cilia well developed..... 3.
Leaves ovate-lanceolate; cells oblong to oblong-linear, broader; cilia poorly developed, short..... 7. *Muhlenbergii*.
3. Costa percurrent or shortly excurrent..... 6. *marchica*.
Costa long and slenderly excurrent; leaves often lanceolate..... 8. *capillaris*.
4. Leaves very broadly ovate-acuminate, often twisted when dry, strongly concave and plicate; margins revolute and doubly serrate..... 5.
Leaves ovate, acute or acuminate to lanceolate, not twisted when dry..... 9.
5. Leaves uniform except at the extreme tips and base of innovations, spreading from the insertion and curving upward and inward when dry..... 11. *americana*.
Leaves dimorphic, either those of the upper or the lower portions of the innovations shorter, obtuse, lax; costa wide at base, percurrent or shorter..... 6.

6. Leaves strongly spirally twisted when dry, deeply concave and often cucullate; upper cells large, 16-20 μ wide..... *11c. var. torquata.*
- Leaves not spirally twisted when dry..... 7.
7. Stems strict; leaves of the lower $\frac{2}{3}$ of the innovations closely appressed, obtuse and strongly plicate, upper ones patent and like typical *americana*..... *11c. f. dimorphophylla.*
- Stems long and lax; leaves distant..... 8.
8. Lower leaves distant, very concave, loosely clasping the stem, obtuse, pale. *11a. f. laxa.*
- Upper leaves distant and smaller, green..... *11d. var. gracilescens.*
9. Leaf margins revolute and doubly serrate (except in *Ph. fontana* var. *tenuis* and *borealis*)..... 10.
- Leaf margins plane or recurved only at the base, not plicate, singly serrate(*) 22.
10. Leaves falcate nearly to the base of stem..... 11.
- Leaves straight, only those at the apex of the stems sometimes falcate..... 12.
11. Leaves lanceolate, slenderly acuminate; costa long-excurrent..... *10d. var. falcata.*
- Leaves oblong-lanceolate, broadly acuminate; costa stout and shortly excurrent..... *12. calcarea.*
12. Leaves in rows; plants robust..... 13.
- Leaves not in rows; plants mostly medium in size..... 14.
13. Leaves in 5 spiral rows, dense, appressed when dry, upper portion widely tapering; costa very stout, strongly papillose at back, shortly excurrent. *10c. var. seriale.*
- Leaves in straight rows, tips divergent, especially when dry, narrowly acuminate; costa strong, excurrent..... *11. americana.*
14. Leaves uniform except at the extreme tips and bases of the innovations... 15.
- Leaves dimorphic, either the upper or the lower ones, shorter, obtuse..... 19.
15. Leaves acute or acuminate; costa percurrent or shortly excurrent..... 16.
- Leaves very slenderly acuminate; costa long-excurrent, lamina not or only slightly plicate; stems densely interwoven with tomentum..... *10d. var. pumila.*
16. Leaves firm, patent to erecto-patent; stems in dense tufts, compact; branches whorled; frequently fruiting..... *10. fontana.*
- Leaves lax, appressed or irregularly spreading; stems in large loose tufts, irregularly branched, sterile..... 17.
17. Stems strict; leaves uniformly appressed, loosely clasping and parallel with the stem, deeply plicate, the lower ones obtuse..... *10f. var. adpressa.*
- Stems lax and flexuose; leaves irregularly appressed to spreading, very lax. 18.
18. Leaves 1.5-2.3 mm. long, concave and plicate..... *10h. var. laxa.*
- Leaves 0.8-1.3 mm. long, nearly plane, not plicate, singly dentate..... *10h.¹ var. laxa f. tenuis.*
19. Lower leaves very concave and cucullate; tips incurved, appressed and clasping..... 20.
- Upper leaves shorter, obtuse; costa ending below the apex..... 21.
20. Upper leaves typical of *Ph. fontana*..... *10a. f. dimorphophylla.*
- Upper leaves typical of *Ph. fontana* var. *pumila*..... *10d.¹ var. pumila f. dimorphophylla.*
21. Lower leaves typical of *P. fontana*..... *10b. var. heterophylla.*
- Lower leaves typical of *P. fontana* var. *pumila*..... *10d.² var. pumila f. heterophylla.*
22. Leaves firm, flat, not concave..... 23.
- Leaves lax, concave..... 24.
23. Leaves distant, closely appressed; costa very slender..... *9. caespitosa.*
- Leaves dense, patent, stems thick; costa wide..... *9a. var. compacta.*
24. Stem lax, slender and weak; leaves patent to subspreading, distant..... *9c. var. laxa.*
- Stems thick and fleshy, rather weak; leaves loosely clasping, parallel with the stem, often dimorphic, lower obtuse; costa wide, ending below the apex..... 25.

* *Ph. fontana* var. *laxa f. tenuis* may be sought here.

25. Leaves broadly ovate, short-acuminate, plane *gb. var. adpressa.*
 Leaves oblong-oval, very lax and concave, distant *rog. var. borealis.*

SIMPLIFIED KEY TO THE SPECIES.

- (This key is inserted for the benefit of those beginning the study of this difficult genus. A. J. G.)
 Perigonia gemmiform, often appearing lateral PHILONOTULA.
 Perigonia discoid, terminal EUPHILONOTIS.

PHILONOTULA.

- | | |
|--|-------------------------|
| 1. Autoicous or polygamous | 5. <i>longiseta.</i> |
| Dioicous | 2. |
| 2. Stems hooked at the tips; upper leaves falcate; costa of the perigonal bracts long spinulose-excurrent | 4. <i>uncinata.</i> |
| Stems not hooked; costa of perigonal bracts percurrent or ending below the apex (rarely short-excurrent) | 3. |
| 3. Leaves oblong-lanceolate and often subfalcate to ovate-acute or ovate-lanceolate, 0.4-1 mm. long; margins plane or slightly recurved, bluntly dentate | 4. |
| Leaves triangular-lanceolate, straight; margins narrowly revolute, sharply serrate; costa slender, shortly or longly spinulose-excurrent | 3. <i>sphaericarpa.</i> |
| 4. Leaves acute or acuminate; costa percurrent or shortly excurrent | 1. <i>glaucescens.</i> |
| Leaves obtuse; costa ending below apex | 2. <i>gracillima.</i> |

EUPHILONOTIS.

- | | |
|---|---|
| 1. Leaf cells papillose at the upper ends | 2. |
| Leaf cells papillose at the lower ends, rarely at upper or both ends | 4. |
| 2. Leaves triangular-lanceolate to ovate-lanceolate; cells linear; cilia of inner peristome well developed | 3. |
| Leaves ovate-lanceolate; cells oblong to oblong-linear, broader; cilia poorly developed, short | 7. <i>Muhlenbergii.</i> |
| 3. Costa percurrent or shortly excurrent | 6. <i>marchica.</i> |
| Costa longly and slenderly excurrent, leaves often lanceolate | 8. <i>capillaris.</i> |
| 4. Leaves broadly ovate-acuminate, often twisted when dry, strongly concave and plicate; margins revolute and doubly serrate | 11. <i>americana.</i> |
| Leaves ovate, acute or acuminate to lanceolate, not twisted when dry | 5. |
| 5. Leaf margins revolute and doubly serrate (except in <i>P. fontana</i> vars. <i>tenuis</i> and <i>borealis</i>) | 6. |
| Leaf margins plane or recurved only at the base, not plicate, singly serrate* | 9. <i>caespitosa.</i> |
| 6. Leaves falcate nearly to base of stem | 7. |
| Leaves straight, only those at the top of the stems sometimes falcate | 8. |
| 7. Leaves lanceolate, slenderly acuminate; costa long-excurrent | 10e. <i>var. falcata.</i> |
| Leaves oblong-lanceolate, broadly acuminate; costa stout and shortly excurrent | 12. <i>calcareo.</i> |
| 8. Leaves in rows; plants robust | 9. |
| Leaves not in rows; plants mostly medium-sized | 10. |
| 9. Leaves in 5 spiral rows, dense, appressed when dry, upper portion widely tapering; costa very stout, strongly papillose at back, shortly excurrent | 10c. <i>var. seriata.</i> |
| Leaves in straight rows, tips divergent, especially when dry, narrowly acuminate; costa strong, excurrent | 4. <i>americana.</i> |
| 10. Leaves uniform except at the extreme tips and bases of the innovations | 10. <i>fontana</i> and vars. |
| Leaves dimorphic, either the lower or the upper shorter, obtuse | 10a. f. <i>dimorphophylla</i> & 10d ¹
var. <i>pumila</i> , f. <i>dimorphophylla</i> . |

* *P. fontana borealis* and var. *laxa* f. *tenuis* may be sought here.

1. *PHILONOTIS GLAUDESCENS* (Hornsch.) Paris, Index (Ed. 1) 1: 923. 1894.

Bartramia glaucescens Hornsch. Fl. Brasil. 1: 40. 1840.

B. tenella C. Muell. Syn. Musc. 1: 481. 1849.

Philonotis Muhlenbergii var. *tenella* Brid. Bryol. Univ. 2: 23. 1827.

Plants small, growing in pale green tufts; stems slender, densely foliate, 1-2 cm. high, tomentose below; leaves oblong-lanceolate, subfalcate, some triangular-lanceolate, 0.6-0.8 mm. long, erecto-patent, bluntly serrate; costa percurrent; margins recurved or plane; areolation hyaline, upper cells oblong-linear to rectangular, papillose at the upper end at back; lower cells gradually becoming larger, oblong, firm but sometimes lax and inflated. Dioicous; perigonium gemmiform, often appearing lateral with one subtending branch or with two or three; perigonal bracts transparent, showing brownish antheridia and paraphyses within, very broadly ovate and clasping at the base, abruptly slenderly lanceolate above, distantly dentate; costa slender and faint, disappearing about half way to the apex; perichaetial leaves lanceolate, costa slender and disappearing, faintly serrate. Seta long, 1-1.5 cm.; capsule ovoid, 1.5-2 mm. long, inclined or cernuous, mouth small and slightly oblique; lid low and convex, yellowish to reddish-brown, furrowed when dry; teeth reddish-brown, strongly barred, finely papillose below, coarser above; basal membrane of inner peristome extending about one third the length of the segments, papillose in lines; cilia diverging in upper third, often very closely adhering, nearly as long as teeth which are 0.3-0.4 mm. long; spores reniform, 22-26 μ , papillose with rounded papillae. Type locality, Brasil.

ILLUSTRATIONS:—Pl. 69 N.

EXSICCATI:—Bro. León 781; Langlois 998; Rapp and Underwood, Florida (no numbers).

Common in the Gulf States, Florida to western Texas; Kansas marks the northern limit. Mexico, Central and South America, West Indies.

This plant grades into *P. gracillima* and *P. sphaericarpa* but the intermediate forms do not seem very common. Some of the lower leaves may be obtuse with the costa ending just short of the apex.

1a. Forma LAXA n. forma.

Cellulis grandibus, oblongis, valde laxis.

Cells large, oblong, thin-walled and very lax. Type locality, Florida. Type in U. S. National Herbarium. Collected by Smith and others, no number. Florida.

1b. Var. TERRESTRIS (Dismier) n. comb.

Ph. tenella var. *terrestris* Dismier, Mém. Soc. Nat. Sci. & Math. Cherb. 36: 367-428. 1908; Bryol. 14: 47. 1911.

Tufts dense, very small, 2-5 mm. high, pale yellowish-green, leaves much the same as in the species but smaller. Type locality, Florida.

ILLUSTRATIONS:—Pl. 67 B, 1.

1c. Var. BREVIFOLIA (Dismier) n. comb.

P. tenella var. *brevifolia* Dismier, l. c.

Plants in small loose tufts 0.5-1 cm. high, stems very slender, leaves ovate-acute, appressed, 0.4-0.6 mm. long, distant and erect. Type locality, Louisiana.

ILLUSTRATIONS:—Pl. 67 B, 2.

2. *PHILONOTIS GRACILLIMA* Ångstr. Öfv. Kgl. Vet.-Akad. Förh. 33: 17. 1876.

Plants small and slender, 1-1.5 cm. high, whorled or irregularly branched, tomentose below, bright green; leaves patent or erecto-patent, ovate-oblong to oblong-lanceolate, often somewhat triangular; margins plane or slightly recurved, bluntly dentate; apex blunt or obtuse; costa ending below the tip; upper cells linear-oblong or shorter, often rhomboidal, weakly papillose on the upper end at the back; lower cells shorter, slightly enlarged, all more or less hyaline and lax, 0.5-1 mm. long. Dioicous; perigonia gemmiform, prominent, often apparently lateral, subtended by one to five branches; bracts transparent, showing the brownish paraphyses and antheridia, 1-1.2 mm. long, with base very broadly sheathing and concave,

abruptly narrowed to a very slender acuminate apex, serrate; upper portion is erect or patent; costa narrow or very faint, ending below the apex or disappearing in the tip; perichaetial leaves erect, oblong-lanceolate to lanceolate, slenderly long-acuminate; costa slender, long-excurrent, faintly serrate above. Seta long, 2 cm., capsule large in proportion to the gametophyte, 1-1.5 mm. long, ovoid, horizontal or nearly so, reddish-brown, furrowed when dry, *mouth small* and slightly oblique; teeth reddish, lanceolate, slenderly acuminate, blunt or knobbed at the tip, strongly barred with round or ovoid thickenings in the upper joints, finely papillose below, coarsely papillose above; inner peristome yellowish, coarsely papillose in longitudinal lines, slightly shorter than the teeth; basal membrane about half the length of the teeth, perforate, cilia often adherent; spores reniform, densely papillose with blunt papillae, 20-26 μ , reddish-brown. Type locality, Central or South America.

ILLUSTRATIONS:—*Pl. 67 A.*

EXSICCATI:—Holzinger, Mus. Acro. Bor. Am. 471.

Gulf states, Kansas to western Texas, West Indies, Mexico, Central and South America.

P. glaucescens is the only species with which this is likely to be confused. In the former the subfalcate leaves are very prominent while only a few of the comal leaves of *P. gracillima* show this character. Obtuse leaves with the costa ending below the apex predominate in this species.

3. PHILONOTIS SPHAERICARPA [Sw.] Brid. Bryol. Univ. 2: 25. 1827.

Mnium sphaericarpum Sw. Prodr. 139, 1788; Hedw. Musc. Frond. 3: 93. *pl. 38a.* 1792 and Sp. Musc. 197. 1801 (*M. sphaericarpon*).

Plants small, in erect tufts 2-3 cm. high, light green, tomentose below, densely foliate; leaves patent to subspreading, *triangular-lanceolate to oblong-lanceolate*, slightly concave at the base; costa slender, *spinulose-excurrent, often rather long; margins revolute*, sometimes nearly plane, *sharply serrate*; upper cells linear to oblong, becoming broader below, papillose at the upper ends. Dioicous; perigonium gemmiform, terminal or subtended by 1-4 branches; bracts transparent, showing the antheridia and paraphyses, tips erect or patent, base very concave and clasping, hyaline, upper portion abruptly long and slenderly lanceolate, 1.3-1.6 mm. long; costa faint and slender, disappearing at about the middle; margins plane and serrate; perichaetial leaves ovate-lanceolate, serrate, 1.5 mm. long; costa slender, percurrent or short-excurrent. Seta 1.5-2 cm. high; capsule reddish-brown, ovoid to globose, inclined or cernuous, 1.5 mm. long, furrowed when dry, mouth small; teeth reddish, 0.3 mm. long, strongly barred with ovoid thickenings in the upper joints, finely papillose below, coarsely papillose above; inner peristome yellowish; basal membrane about half the length of the segments, perforate; cilia adherent, coarsely papillose in longitudinal lines; spores reniform, 23-26 μ , papillose, yellowish-brown. Type locality, Jamaica.

ILLUSTRATIONS:—*Pl. 69 J.*

EXSICCATI:—Specimens collected by Rapp, Austin, and Smith in Florida are in various herbaria without numbers.

This plant seems to be known only from Florida but is to be looked for in all the Gulf States. It is common in the West Indies, Mexico, Central and South America.

3a. Var. TERRESTRIS Dismier, Mém. Soc. Nat. Sci. & Math. Cherb. 36: 367-428. 1908.

Plant very small in short tufts about 1 cm. high; *leaves smaller and shorter, 0.8-1.5 mm. long, hyaline, triangular-lanceolate, costa shortly excurrent.* Sterile. Type locality, Florida.

ILLUSTRATIONS:—*Pl. 69, J-6.*

EXSICCATI:—Lighthipe, Florida, no number.

Distribution: Florida.

4. PHILONOTIS UNCINATA (Schwaegr.) Brid. Bryol. Univ. 2: 22. 1827.

Bartramia uncinata Schwaegr. Suppl. 1^o: 60. 1816.

B. scabrida Schwaegr. l. c. 57.

Plants in loose or compact tufts, 2-3 cm. high, bright yellowish-green or pale green, reddish tomentose below; stems simple or with whorled branches, densely foliate and leaves imbricated when dry, *stem tips hooked; leaves oblong-lanceolate to triangular-lanceolate, imbricated, erecto-patent to patent, the upper sub-falcate, 1-1.5 mm. long, mostly 1.2 mm.; costa stout, shortly excurrent; margins strongly revolute, serrate;*

areolation small, cells parallel, upper linear, becoming broader below, oblong to rectangular, *all densely scabrous with papillae at the upper ends*. Dioicous; perigonia prominent, subtended by one to five whorled branches, sometimes terminal; leaves erect to patent, base broadly ovate and clasping, brownish or yellowish, hyaline, abruptly narrowed to a long-lanceolate apex, green, serrate above, sometimes revolute; costa very slender but well defined, disappearing or excurrent into a spinulose point; perichaetial leaves oblong at the base, becoming lanceolate or linear above, dentate; costa slender, disappearing near the tip or excurrent. Seta 1-2.5 cm. long, often flexuose; capsule inclined to cernuous, ovoid to shortly oblong, 1.5-2 mm. long, yellowish-brown, mouth small; lid low-convex with a blunt point; teeth reddish-brown, 0.34 mm. long, strongly barred with ovoid or globose thickenings in the upper joints, finely papillose below, becoming coarse and high above; inner peristome yellowish, perforate, coarsely papillose in longitudinal lines, nearly as long as the teeth, basal membrane reaching about half their length; cilia adherent, often non-divergent; spores ovoid to reniform, 23-26 μ , bluntly papillose. Type locality not definitely known but probably in the West Indies.

ILLUSTRATIONS:—Schwaegr. Suppl. 1², pl. 57; Pl. 69 M.

EXSICCATI:—Holz. Mus. Acro. Bor. Amer. 415; Grout, Musci Perfecti 69; Rapp, no number.

Florida, especially in phosphate soil; Louisiana, West Indies, Mexico, Central and South America.

This plant resembles *P. sphaericarpa* more closely than any other species. The densely imbricated triangular-lanceolate leaves in delicate feathery tufts of pale green give them both a similar appearance. I have noticed, however, that *P. uncinata* is more sharply serrate, densely scabrous and more constantly revolute. It also resembles *P. longiseta* in habit and scabrous leaves with parallel areolation but it is smaller than the latter, the leaves smaller and the stem tips hooked. *P. longiseta* is autoicous, a character that is usually very easily demonstrated.

5. *PHILONOTIS LONGISETA* (Rich.) E. G. Britton. Bryol. 14: 44. 1911.

Bartramia longiseta Rich. Michx. Flora Amer. Bor. 2: 301. 1803.

Philonotis radicalis (P. Beauv.) Brid. Bryol. Univ. 2: 16. 1827.

Bartramia radicalis P. Beauv. Prodr. 44. 1805.

Plants in rather loose or dense tufts, stems rather lax, simple or with whorled branching, yellowish-green or green, somewhat tomentose below, 1-2.5 cm. high; leaves erecto-patent to patent, often closely disposed, especially at the ends of the stems, lanceolate to triangular-lanceolate, 1-1.5 mm. long; costa rather weak, percurrent to strongly excurrent, sometimes disappearing; margins closely revolute, strongly serrate with blunt teeth; lamina strongly papillose all over; upper cells rectangular to linear, parallel, papillose at the upper ends; lower cells gradually enlarged but not becoming as strongly differentiated as in related species, rarely inflated, papillose. Autoicous; perigonia small, lateral or subtended by whorled branches; leaves erect or erecto-patent, base ovate or oblong and clasping, hyaline, abruptly narrowed to a long slender lanceolate apex, 1.5-2 mm. long; costa weak and disappearing below the tip; margins weakly dentate; perigonia borne just below the perichaetium as lateral gemmiform buds. Perichaetia small, with closely appressed leaves which are 1.5-2 mm. long, lanceolate from an ovate or oblong base, apex slenderly acuminate, margins dentate, costa excurrent. Seta 1.5-2 cm. long, reddish-brown, straight or flexuose; capsule inclined or cernuous, ovoid to subglobose, 2 mm. long, gibbous above, mouth small, slightly oblique; lid low-conic; teeth reddish, lanceolate-acuminate, 0.4-0.5 mm. long, strongly barred, with ovoid or globose thickenings in the upper joints, finely papillose below, coarser above; inner peristome yellowish, shorter than the teeth, papillose in longitudinal lines; cilia mostly adhering to one another or non-divergent; spores reniform, papillose, 22-26 μ . Type locality, eastern U. S.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 52; Engler & Prantl 10: 462, fig. 404; Pl. 69 K.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 169, (Ed. 2) 254; R. & C. Musc. Am. Sept. 54; Holz. Musc. Acro. Bor. Am. 94; Grout, Musci Perfecti 264; Bro. León 876. Specimens collected by Smith, Mohr, Sharp and Langlois have no numbers.

Pennsylvania, Ohio, Tennessee, south to Alabama, Florida, Georgia and Louisiana.

This plant is much like *P. uncinata* but the latter is more densely foliate with imbricated leaves, the stem tips hooked and is dioicous.

5a. *Forma PROPAGULICULIS* Bryol. 38: 8. pl. 3. 1935.

Stems prolonged and slender with small much reduced leaves rather abruptly differentiated from the lower normal ones, 0.2-0.4 mm. long with brood branches or gemmae in the axils. Brood bodies with oblong or linear stems and a tuft of tiny leaves at the tip. Sterile. Type locality, Louisiana.

ILLUSTRATIONS:—*Pl. 69 L.*

Collected by Bro. León in Louisiana. Type in U. S. Nat. Herbarium.

Nearly all species of *Philonotis* are known to produce gemmae or brood branches in the axils of the leaves. The species of the section *Philonotula* are more prominent in this respect than those of *Euphilonotis*. In this variety the very evident habit is striking and the gemmae are very abundant, nearly every stem having them.

5b. *Forma POLYGAMA n. forma.*

Plantae autoicae vel synoicae. Ubi autoicae, perigonia sub perichaetiis. Perigonia tenella, angusta, antheridiis paucis. Folia perigonia ovata vel oblongo-lanceolata, interiora abrupte angustata ad basem oblonga, minus lata et concava quam in specie, 1.5–2 mm. longa, apice angusta, costa supra evanescente; margine revoluta, serrata.

Plants somewhat smaller than the species but otherwise much the same. *Autoicous and synoicous in the same plant.* When autoicous the perigonia are borne immediately below the perichaetia, small and narrow with only a few antheridia in the clusters; *perigonia ovate- to oblong-lanceolate*, the inner ones rather abruptly narrowed from the oblong base but *not as broad nor as strongly concave at the base as in the species*, 1.5–2 mm. long; apex slender; costa disappearing; margin revolute to near the apex, at least on one side, serrate above. Perichaetium similar to the species. Type locality near Careyville, Campbell Co., Tennessee, on moist roadside bank (Sharp). Type in herbarium of Seville Flowers.

ILLUSTRATIONS:—*Pl. 67 C.*

EXSICCATI:—Sharp 34154.

A. J. Sharp discovered this little plant. The very abundant reproductive organs show the polygamous character very convincingly.

5c. *Var. PORTERI (Aust.) n. comb.*

Philonotis radicalis var. *Porteri* Aust. Bull. Tor. Bot. Club 6: No. 36. 1877.

Plants with habit of the species, slender, leaves much narrower, very slenderly triangular-lanceolate, areolation laxer and broader. *Seta short, about 1.3 cm. long; capsule subglobose, 1.5 mm. in diameter, thin-walled, when dry indistinctly furrowed and minutely rugulose, mouth small; lid low-convex without tip; peristome as in the species.* Type from Ohio, Beardslee. Type seen.

6. *PHILONOTIS MARCHICA* (Willd.) Brid. Bryol. Univ. 2: 23 & 735. 1827.

Bartramia marchica Brid. Musc. Recent. Suppl. 4: 116. 1819.

Leskea marchica Willd. Flor. berol. Prodr. 319. pl. 6. 1787.

Philonotis subcapillaris Kindb. Eur. & N. Am. Bryin. 326. 1897, in part.

Plants in loose or cespitose tufts, bright green, tomentose below; stems 3–8 cm. high; leaves erecto-patent to patent, *ovate-lanceolate to lanceolate-triangular*, 1.5–2 mm. long, slightly concave at the base; costa slender and shortly excurrent to spinulose-excurrent; margins serrate, often weakly so, plane or revolute; upper cells *linear-oblong, parallel*, lower cells becoming larger and broader, papillae at the upper ends, *often scabrous and persisting to the base.* Dioicous; perigonia large, terminal or subtended by whorled branches; leaves broadly sheathing at the base, squarrose, tapering to a lanceolate apex, 2–2.5 mm. long, serrate, acute or acuminate; costa broad and indistinct at the edges, disappearing below the apex; perichaetial leaves ovate-lanceolate, 2–2.5 mm. long, base oblong, tapering to a slender apex, serrate; costa shortly excurrent. Seta 2–4 cm. long; capsule ovoid to subglobose, 2–2.5 mm. long, inclined or cernuous, mouth small and oblique, furrowed when dry; lid low-convex, bluntly pointed; teeth reddish, strongly barred with ovoid or globose thickenings in the upper joints, finely papillose below, coarser above; inner peristome yellowish, slightly shorter than the teeth, coarsely papillose in lines; cilia adhering to one another or diverging in upper half, sometimes poorly developed, sometimes nearly equaling the segments; spores reniform, 23–26 μ , reddish-brown, bluntly papillose. Type locality European.

ILLUSTRATIONS:—Limpr. Laubm. 2: 561. fig. 315; Husnot, Musc. Gall. pl. 74; Schimp. Bryol. Eur. pl. 323; Monkemeyer, Laubm. 583, fig. 120-ak; *Pl. 69 G.*

EXSICCATI:—Aust. Musc. Appal. 225 & 226; Morris 966; Thompson 1887; Macoun, Can. Mosses 173; Lighthipe 117; Burnett 1169; Killip 2088; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 168 (as *Bartramia Muhlenbergii*).

Maine to Georgia, Texas to Illinois, Minnesota and eastern Canadian provinces.

This plant together with *P. Muhlenbergii* and *P. capillaris* form a transitional group between *Philonotula* and *Euphilonotis*. The former is characterized by the smaller size of the plants, narrower leaves, gemmiform perigonia with erect or patent bracts, narrowly lanceolate above. The cells are papillose at the upper ends. The species of *Euphilonotis* are larger, usually with larger leaves, papillose at the lower ends of the cells, perigonia discoid with large squarrose bracts, seldom patent, more broadly lanceolate above and often shortly ovate and with a broader costa. The transitional group shows combinations of these characters. All have the discoid perigonia of *Euphilonotis*. *P. marchica* has most of its other characteristics typical of *Philonotula* but is much larger. *P. Muhlenbergii* has poorly developed cilia, a character sometimes noted in *Philonotula*; the leaves are larger and resemble those of *P. caespitosa*, the papillae are usually weak, occurring at the upper ends of the cells or at both ends. *P. capillaris* has long lanceolate leaves with papillae at the upper ends of the cells but otherwise belongs in *Euphilonotis*. It seems to grade into *P. fontana* var. *pumila*.

7. *PHILONOTIS MUHLENBERGII* (Schwaegr.) Brid. Bryol. Univ. 2: 22. 1827.

Bartramia Muhlenbergii Schwaegr. Suppl. 1^o: 58. pl. 61. 1816.

Plants in loose or dense tufts with the aspect of *P. caespitosa* or forms of *P. fontana*; bright green, tomentose below; stems 3–6 cm. high; leaves patent, *ovate-lanceolate*, straight or falcate, 1.2–2 mm. long; costa rather strong and shortly excurrent; margins plane, singly serrate; *areolation larger than in P. marchica*, cells mostly oblong above, not noticeably parallel, upper cells weakly papillose at upper ends, often at both ends, papillae usually lacking in the much enlarged lower cells. Dioicous; perigonial leaves squarrose, base broadly sheathing, hyaline or brownish, upper portion triangular-lanceolate or oblong-lanceolate; inner ones blunt, the outer acute or acuminate, serrate; costa indistinct and disappearing; largest leaves 2 mm. long; perichaetial leaves ovate-lanceolate, long-acuminate, 1.8–2.3 mm. long; costa strong and ending in the point or shortly excurrent. Seta 2–3 cm. long; capsule ovoid to subglobose, 2 mm. long, inclined or cernuous, reddish-brown, furrowed when dry, lid low-convex with a short point; teeth reddish-brown, 0.4–0.5 mm. long, lanceolate, strongly barred, with ovoid or globose thickenings in the upper joints, finely papillose below, coarser above; inner peristome yellowish, coarsely papillose in lines, basal membrane about half the length, perforate; cilia shorter than the segments and poorly developed, often non-divergent; spores reniform, 24–27 μ , reddish-brown and bluntly papillose. Type locality, Pennsylvania.

ILLUSTRATIONS:—Jennings, Mosses of W. Pennsylvania, pl. 24; Pl. 69 H.

EXSICCATI:—Macoun, Can. Musci. 415b; Cathcart, no number; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 253. Virginia to Maine, west to Colorado and British Columbia.

This plant has been treated as a synonym of *Philonotis marchica*. It is clearly an intermediate form between the *Philonotula* and *Euphilonotis* groups and is more closely related to forms of *P. caespitosa* than any other species. In its typical form *P. marchica* has triangular-lanceolate leaves with the cells papillose at the upper ends and arranged in more or less parallel rows. *P. Muhlenbergii* has the leaves ovate-lanceolate, the costa broader, the cells in no apparent parallel arrangement and the papillae usually weak and rather difficult to observe. Very often the papillae occur at both ends of the cells and do not persist to the base of the leaf as they do in *P. marchica*. The cilia are poorly developed and shorter than the segments. Some forms of *P. fontana* have many of the cells papillose at the upper ends and one specimen in particular had all of the leaves strongly papillose at the upper ends but all of the other characters so convincingly *fontana* that it must be considered as an intermediate form.

8. *PHILONOTIS CAPILLARIS* Lindb. Hedwigia, 40: 1876; Hartm. Skand. Fl. (Ed. 10) 2: 40. 1871.

Ph. Macounii L. & J. Manual, 208. 1884.

Ph. vancouverensis Kindb. Eur. & N. A. Bryin. 326. 1897.

Plants erect or somewhat procumbent in rather dense or loose tufts, 1–3 cm. high, slender, yellowish-green to bright green; leaves patent to spreading, *oblong-lanceolate to slenderly lanceolate*, 1–1.8 mm. long; costa long-excurrent; margins plane or narrowly revolute on one or both sides, strongly and simply serrate above, dentate to nearly entire below; upper leaf cells oblong-linear, papillose at the upper ends, lower leaf cells broader and smooth. Dioicous; perigonia discoid; leaves sheathing at the base, upper portion patent, triangular- or ovate-lanceolate, 1.5–2 mm. long, mostly acute, the inner ones occasionally blunt, strongly serrate; costa faint and ending below the apex; perichaetial leaves longly and slenderly acuminate from an oblong base; costa excurrent. Seta 2–2.5 mm. long, reddish-brown, straight or flexuose; capsule ovoid to globose, inclined or cernuous, 1.3–1.8 mm. long, furrowed when dry, mouth small, slightly oblique; lid low-conic, mammillate; teeth reddish-brown, strongly jointed, 0.4–0.6 mm. long, with ovoid or globose thickenings in the upper joints, finely papillose below, coarser above; inner peristome yellowish, coarsely papillose, cilia well developed; spores reniform, 23–28 μ , bluntly papillose. Type locality, Sweden.

ILLUSTRATIONS:—Dixon & Jam. Handbook Brit. Mosses, (Ed. 3) *pl.* 39-K; Broth. Laubm. Fennosk. 358, *fig.* 63, A-B; Husnot, Musc. Gall. *pl.* 74; *Pl.* 69 I.

EXSICCATI:—Holz. Musc. Acr. Bor. Amer. 440; do. & Eur. 543; Bartram 101; Macoun, Can. Musci 415a, 415, 152; Canby 487; Coville & Kearney 585.

Maine to Virginia, New Mexico, Arizona, Washington, British Columbia and Alaska.

This is a small delicate plant with slender stems and spreading leaves. It resembles smaller forms of *P. fontana* var. *pumila* and has often been confused with *P. marchica*. The papillae at the upper ends of the cells are often faint and difficult to demonstrate, the lamina sometimes appearing smooth. It grades into *P. Muhlenbergii* and some forms are difficult to separate especially when sterile. The narrower leaves and long-excurrent costa of typical forms make its identification easy, but when the leaf base is broader and the costa shortly excurrent, it remains for the habit and sporophyte characters to separate it from the others.

9. PHILONOTIS CAESPITOSA Wils. Mss. Musc. Brit. No. 278; Milde, Bry. Siles. 241. 1869.

Braithw. Brit. Moss Flora 2: 210. 1893.

P. fontana var. *caespitosa* (Wils.) Schimp. Syn. (Ed. 2) 2: 520. 1876.

Plants in deep tufts, loose or compact, yellowish-green or pale glaucous-green, tinged with red; stems very slender, 3-8 cm. high; leaves rather closely inserted, *erecto-patent, ovate-acuminate or acute, apex usually rather short, concave, plane; margins flat and singly serrate; costa slender*, sometimes broad at the base, ending just below the apex or percurrent, seldom shortly excurrent; upper cells oblong to rectangular or ovate-oblong, *rather wide*, papillose at the lower end, often at both ends or a few at the upper end; in some forms the papillae are weak; lower cells enlarged, thin-walled and often inflated, papillae weak or wanting. Leaves of the male stems ovate-lanceolate, very strongly appressed, costa slender, percurrent or shortly excurrent. Some plants often have falcate leaves near the apex of the stem. Dioicous; perigonal bracts broadly sheathing at the base, brownish or yellowish, abruptly narrowed to a triangular-ovate or ovate-lanceolate upper portion, squarrose, margins strongly serrate above; costa broad but indistinct, ending below the acute or obtuse apex. Capsules as in *Ph. fontana*. Type locality, Germany, 1862.

ILLUSTRATIONS:—Dixon & Jam. Handbook Brit. Mosses *pl.* 39-G; Braithw. Brit. Moss Flora 2: 77-E; Husnot, Musc. Gall. *pl.* 75; Monkemeyer, Laubm. Eur. 583, *fig.* 120-b; *Pl.* 69 B.

EXSICCATI:—Collins 2410.

9a. Var. COMPACTA Dismier, Mém. Soc. Nat. Sci. Nat. & Mat. Cherb. 36: 367-428. 1908. Bryol. 14: 51. 1911.

Differs from the species in the thicker stems with the *leaves more numerous and closely inserted*, patent, areolation firm; *costa broader at the base and stronger above*. Type locality in Connecticut, Nichols.

ILLUSTRATIONS:—*Pl.* 69, E.

EXSICCATI:—Nichols C-712.

9b. Var. ADPRESSA Dismier, Rev. Bryol. 34: 68. 1897.

Stems long and slender, often flexuose, irregularly branched, often simple; *leaves erect and appressed, often loosely clasping and parallel with the stem, distant, broadly ovate, short-acuminate or acute, concave*, lamina without plicae; costa broad at base and rather wide above, percurrent; margins plane and singly serrate; *lower leaves shorter and acute, some of them obtuse and the costa ending below the apex*. Upper areolation firm, the base lax. Sterile. Type locality European. *Pl.* 69 D.

EXSICCATI:—A specimen from North Carolina collected by Dr. Best seems to be the only representative of this variety that has been distributed.

The plant is a parallel form of *P. fontana* var. *adpressa*. It has been collected in New Hampshire, New Jersey and North Carolina.

9c. Var. LAXA (Warnst.) Loeske & Warnst. Hedw. 45: 104. 1906.

Ph. laxa Warnst. (not Limpricht), Krypt. Flora M. Brand 2: 618, 1905.

A slender flexuose plant with branching irregular or whorled, forming loose tufts, 3-8 cm. high; leaves oblong-ovate or oblong-lanceolate, *acuminate, lax and spreading*; costa broad below, slender above, percurrent; lamina flat, margins plane and singly serrate; upper cells rather large and thin-walled, lower cells larger and very lax, papillae weak, often apparently lacking; sterile. Type locality, European.

ILLUSTRATIONS:—Monkemeyer, Laubm. Eur. 583, fig. 120-c and p. 586, fig. 122-b; Möller, Ark. f. Bot. 19¹¹: 26, fig. 14; Pl. 69 C.

Specimens have been collected in New York, Connecticut and District of Columbia.

Most of the specimens in American herbaria are single collections from widely distributed stations. The species is probably much more common than has formerly been supposed, and the varieties are probably common also. The species has been collected in nearly all parts of North America, but thus far the varieties have been collected in the eastern part of the United States.

10. PHILONOTIS FONTANA Brid. Bryol. Univ. 2: 18. 1827; Schimp. Syn. (Ed. 2) 519. 1876; L. & J. Man. 209. 1884; Dixon & Jam. Handbook Brit. Mosses (Ed. 2) 321. 1904.

Mnium fontanum [L.] Hedw. Sp. Musc. 195. 1801.

Bartramia fontana Sw. Schrad. Jour. 2: 183. 1800; Bryol. Eur. 4: fasc. 12. 1842.

Plants in dense tufts, stems parallel or loose above, 3-10 cm. high, slender, densely tomentose below, bright green, often yellowish, pale or glaucous, tinged with red; leaves of sterile or female branches rather dense and imbricated in five rows, patent to erecto-patent, mostly straight but often falcate or secund at the ends of the stems; typically ovate-lanceolate with a broad base and slender acuminate apex, 1.5-2 mm. long, 0.7-1.3 mm. broad at the base; costa stout at the base tapering to the apex, percurrent or shortly excurrent, red and prominent at the back; lamina concave with one or two plicae on either side of the costa; margins strongly revolute half way or more, doubly serrate, often merely dentate toward the base; upper cells typically linear to oblong, incrassate, papillose at the lower end of the cell, occasionally at both ends; basal cells larger and broader, thin-walled, oblong, extreme basal rows often lax and inflated; stems of ♂ plants red and prominent; leaves distant and closely appressed, smaller, narrower but the apex less tapering; areolation laxer, papillae not as strongly developed; costa shorter and often ending just below the tip. Dioicous, perigonal discs terminal or subtended by 1-7 whorled branches, prominent and red; perigonal leaves large, 1.5-2.5 mm. long; base broadly sheathing, hyaline or brownish, cells large and often lax, the upper portion abruptly narrowed, triangular, the inner ones obtuse, the outer obtuse or acute; costa very broad but indistinct and disappearing below the apex; margins plane and serrate, cells linear to oblong; perichaetial leaves ovate-lanceolate to lanceolate, 2-3 mm. long, rather broad at the base and tapering to a long slender apex; costa shortly excurrent. Seta 2-4 cm. high, reddish-brown; capsule 2-3 mm. long, ovoid to subglobose, inclined or cernuous, mouth oblique, rather small when dry, oblong, slightly curved and furrowed; lid conic; teeth reddish-brown, strongly barred, with ovoid or globose thickenings in the upper joints, 0.4-0.5 mm. long, lanceolate, finely papillose below, very coarsely above; inner peristome yellowish, keeled, perforate, nearly as long as teeth, coarsely papillose above; basal membrane about one fourth or one third the length; cilia well developed, filiform and jointed; spores ovoid to reniform, 24-28 μ , reddish-brown to dark brown, bluntly papillose, maturing at various times according to altitude and latitude; earliest about June 1st. Type locality in Germany.

ILLUSTRATIONS:—Bry. Eur. pl. 324; M. H. M. f. 103; Dixon & Jam. Handb. Brit. Mosses, (Ed. 3) pl. 34-E; Grout, Moss Flora of N. Y. pl. 5; Jennings, Mosses of W. Pennsylvania, pl. 25; Braithw. Brit. Moss Flora, 2: pl. 73-B; Monkemeyer, Laubm. Eur. 585; Limpr. Laubm. 2: 568; Husnot, Muscol. Gall. pl. 74; Möller, Ark. f. Bot., 19¹¹: 44-47, figs. 26-29; Pl. 70 A.

EXSICCATI:—Drumm. Musc. Am. 241; Holz. Mus. Acro. Bor. Amer. 70; Macoun, Can. Musci 416; Can. Mosses 174; Grout, Musci Perf. 13; Aust. Musc. Appal. 223; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 166, 167.

On wet soil or emergent in water, around springs, mountain brooks, wet meadows, swamps and lake shores, often under snow banks. It is widely distributed throughout the United States and Canada to Alaska and Greenland. It is particularly abundant in mountains.

The above description was drawn from the majority of typical forms, but numerous variations within the range of the species exist and, if named, would lead to an endless number of forms and varieties the segregation of which would create confusion and defeat its purpose. Variation in the habit and leaves of fertile, male and sterile stems leads to a combination of characters difficult to include in a single description without numerous phrases of exceptions. It has been noted that typical fertile stems may be accompanied by erect male branches without subfloral innovations, the leaves appressed, narrower and less tapering than those of the fertile stems. Again, in cases where the male stems have developed subfloral innovations the leaves on the main stem may have the form as described above but very frequently resemble those of the fertile plants while the leaves of the whorled innovations are generally smaller and narrower. To add to this array of combinations a third condition exists. Sterile stems with or without whorled branches present a similar diversity of habit and leaf form.

In deep tufts where several seasons' growth may be observed, it is a common feature to find that the leaves of one season differ considerably from those of the previous season. On long simple stems I have found that the leaves of former seasons are generally broader than those on the current year's growth, while

in some cases they are longer with longer excurrent costae. The question arises, when do the leaves reach their maximum development? It may be assumed that they either reach full growth at the end of the season or continue growth for a short time the following season. The time of collection must not be overlooked. Plants collected early in the season would naturally show leaves that are not fully developed. In all cases it is necessary that the older leaves among the rhizoids should be examined, for it is these leaves that show the highest development. All of these features concern *Philonotis fontana* as a species. Similar variations occur in the several varieties.

Variations of a larger degree are included among the varieties described below. Typically *P. fontana* grows on very wet soil, humus, rotten logs, etc., forming compact tufts with rather strict stems. In dense shade it is usually more lax and of darker green color. At high altitudes plants grade into varieties *pumila*, *falcata* and forms of *seriata* and *calcareae*. When plants grow in water the stems become longer and more slender according to the amount or depth of the water. Floating forms are generally very lax. Plants growing submerged or under snow banks or in very cold brooks often assume the lax habit of varieties *laxa*, *borealis* and *heterophylla*. Under these conditions the leaves become lax, closely appressed to the stems and usually dimorphic.

Broad-leaved forms approach *P. americana* but in the latter the leaves are arranged in straight rows and usually have a characteristic dry habit. Forms with long slender excurrent costae grade into variety *pumila*. *P. caespitosa* is distinguished by the flat leaves with very slender costae, nearly flat margins singly serrate above. It has parallel varieties in *P. fontana* and *americana*.

10a. Forma DIMORPHOPHYLLA n. forma.

Plantae breves, rigidae, caespitosae. Folia innovato superiore patentia sicut in specie; folia inferiora appressa, brevia, lata, concava; apex brevis et obtusus, costa sub apice terminata. Steriles.

Plant usually in short dense tufts, strict; upper leaves typical of the species and forming a patent tuft at the tips of the innovations; lower leaves closely appressed, shorter and broader, very concave, apex shorter and becoming obtuse, the costa ending below the apex. Sterile. Type locality, Alaska. Pl. 70 K.

No exsiccati have been issued but several plants from Alaska and British Columbia have been observed. *Dimorphophylla* forms occur in var. *pumila* and *P. americana* also. They are merely habitat forms that may be very misleading as the lower leaves in all have a strong resemblance to those of var. *adpressa* and *borealis*. The strict habit, short innovations and patent upper leaves give them a characteristic appearance. Many of them have apparently been collected under snow banks or in places of unusual conditions such as would cause the lower leaves produced early in the season to assume a different form while the upper or later leaves would take the normal form. The single sketch serves also for var. *pumila* f. *dimorphophylla*.

10b. Var. HETEROPHYLLA Card. & Thér. Univ. Cal. Publ. (Bot.), 2: 300. 1906.

Plants in loose tufts, stems rather fleshy; leaves distant, dimorphic, the lower ones typical of the species, upper ones shorter and imbricated; margins plane or revolute only at the base, very lax, cells short. Perigonial leaves costate to the apex, obtuse or acute. Pl. 70 J.

Perhaps this is only a habitat form. Three specimens seen have widely varying aspect of habit but agree fairly well in the structure and arrangement of the leaves. Alaska, Aleutian Islands, Selkirk Mts., Montana and Maine are given as the localities but specimens from Alaska and Selkirk Mts. are the only ones seen.

10c. *Var. SERIATA Breidl. Laubm. Steierm. 152. 1891.

Bryum lycopodiiforme Schleich. Cat. Pl. Helv. (Ed. 2) 28. 1807 (*Nomen nudum*).

Bartramia seriata Mitt. Musc. Indiae orient. 63. 1859.

Plants larger and more robust than the species. In its typical form the stems are subtumid with the leaves closely disposed in spiral rows, especially at the ends of the stems; leaves ovate-lanceolate more or less evenly tapering to the apex, 1.5–2 mm. long; costa very stout and prominent at the back, percurrent or shortly excurrent, highly papillose on the back; lamina plane or plicate at the base, revolute and strongly doubly serrate. The upper leaves are rather strongly falcate, lower ones straight. Male discs and capsules as in the species. Type locality, Switzerland.

ILLUSTRATIONS:—Dixon & Jam. Handb. Brit. Mosses, (Ed. 3) pl. 39-I; Braithw. Brit. Moss Flora, pl. 78-A; Broth. Laubm. Fenno. 358. f. 63-H; Monkemeyer, Laubm. Eur. 583, f. 120-d; Moller, Ark. f. Bot. 19¹¹: 60–63, figs. 32–35.

This variety in its typical form is not definitely known to be American. Dismier says that specimens from Greenland and Alaska approach it the closest but the specimens I have seen are not convincing when

* This description was drawn from well authenticated European specimens and is included for convenient reference.

compared with European plants. Most of the exsiccati issued under this name are too small and the leaves do not compare favorably with well authenticated plants from Europe. It is with reluctance that I am forced to disagree with the opinions of such able bryologists as Holzinger, Best and Loeske. I have not seen a single American plant as robust as either typical *seriata* or *calcareae*. The best I have been able to convince myself in this direction is that certain smaller forms approach *seriata*, and if, indeed, they are to be related to this variety they should be treated as forms. In order that these doubtful variations be accounted for, I propose that they be called

10c. *Forma OCCIDENTALIS* n. forma.

Habitus et amplitudo speciei. Folia dense inserta, dispositione spirali vel raro vel non manifesta; costa valida, non valide papillosa in dorso, ovato-lanceolata, falcata vel erecta, non plicata; folia inferiora lata et plicata, acuminata.

Plants of the habit and size of the species, often somewhat larger and with leaves more closely disposed, occasionally suggesting a spiral arrangement; costa slightly stouter but not strongly papillose at the back; ovate-lanceolate, falcate above, not plicate, lower leaves broader and plicate, all rather long pointed. *Pl.* 69 *F.* Type locality, New Mexico, Standley 13432, determined by Holzinger.

EXSICCATI:—Holz. Musc. Acro. Bor. Amer. 316, 369; Standley 13432; Grout, Colorado; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 165 (as *Bartramia calcarea*).

Rocky Mts., Alaska, Canada, Labrador, Nova Scotia.

10d. Var. *PUMILA* Brid. Bryol. Univ. 2: 20. 1827.

Ph. alpicola Jur. in sched. Lorentz, Moosst. 170. 1862.

Ph. fontana var. *columbica* Kindb. Macoun, Cat. Can. Plants, 6: 107. 1892.

Ph. acutiflora Kindb. Hedwigia 35: 67. 1896.

Ph. tomentella Mol. emend. Loeske, Hedwigia 45: 203. 1906.

Ph. microcarpa Kindb. Ottawa Naturalist 23: 147. 1909.

Ph. fontana var. *tomentella* (Mol.) Dixon and Jam. Handb. Brit. Mosses (Ed. 3) 320. 1924.

Plants in dense closely cohering tufts, 3-10 cm. high; stems slender and parallel, densely tomentose below, bright green above; leaves appressed or erecto-patent, the tips spreading, especially when dry, often slightly falcate and secund, ovate and long slenderly acuminate to ovate-lanceolate, 1.2-2 mm. long; costa long-excurrent, slender; margins doubly serrate, strongly revolute, often nearly to the apex; lamina plane or only slightly plicate near the base; perigonal leaves triangular-ovate to triangular-lanceolate above, mostly acute, inner sometimes obtuse, serrulate; costa broad and indistinct, disappearing. Capsule as in species. Type locality, Hungary.

ILLUSTRATIONS:—*Pl.* 70 *E*; Dixon & Jam. Handb. Brit. Mosses, (Ed. 3) *pl.* 39-*F*; Broth. Laubm; Fenno. 358, *f.* 63-*F*; Monkemeyer, Laubm. Eur., 586, *f.* 122-*E*; Möller, Ark. f. Bot. 19^u: 32-35, *figs.* 19-23.

EXSICCATI:—Holz. Musc. Acro. Bor. Amer. 441; Can. Crypt. 43; Can. Mosses 170a; Baker 592, 1586; Macoun, Can. Musci 416; Henderson 3745; Brandegee 87; MacDougal 861; Nelson 6110; Cowles 795; Can. Mosses 172a as *P. microcarpa*.

10d¹. Var. *PUMILA* forma *LONGIFOLIA* n. forma.

Plantae grandiores, pallide virides vel stramineo-virides. Folia dense inserta, lanceolata vel oblongo-lanceolata, 1.5-3 mm. longa, erecto-patentia, imbricata, costa angusta et longe spinulosa-excurrent; folia superiora apicibus capillaceis.

Plants larger, pale green, densely foliate; leaves lanceolate to oblong-lanceolate, erecto-patent and imbricated; costa slender and long spinulose-excurrent, 1.5-2.5 mm. long. Comal leaves with very long points, hair-like. Type locality, Nevada, Baker 1586. Type in U. S. National Herbarium.

10d². *Forma DIMORPHOPHYLLA* n. forma.

Plants slender, in short strict tufts; upper leaves patent and forming a tuft at the tips of the innovations; lower leaves appressed, shorter, concave; costa short, tips blunt. Type locality, Alaska.

Specimens collected by Grace Meeker with no number are merely habitat forms. Parallel forms occur in *P. americana* and in *P. fontana*. See notes under *fontana* forma *dimorphophylla*.

10d³. Forma *HETEROPHYLLA* (Dismier) n. comb.

Philonotis tomentella var. *heterophylla* Dismier, Bryol. 14: 50. 1911.

Differs from the variety in that the stems end in very slender innovations which have the leaves distant, and of wholly different form and structure from those of the main stems. (Fide Dismier.)

Selkirk Mts., B. C. No specimens were available for observation.

10e. Var. *FALCATA* Brid. Bryol. Univ. 2: 21. 1827; * Schimp. Syn. (Ed. 1) 520. 1860; Dixon & Jam Handbook of Brit. Mosses (Ed. 3). 320.

Ph. fallax Dismier in part, Mém. Soc. Nat. Sci. & Math. Cherb. 36: 367-428. 1908.

Plants large, usually stouter than the species, in dense radiculose tufts, 3-10 cm. high, yellowish-green with reddish-brown tomentum below, stems parallel or whorled above; leaves falcate and secund, stem tips hooked; leaves of the sterile and female stems ovate-lanceolate to oblong-lanceolate, long and slenderly acuminate; costa rather slender and long-excurrent; margins revolute and doubly serrate. Perigonia and capsules as in the species. Type locality European.

ILLUSTRATIONS:—Pl. 69 A.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 517; Collins 3593; Leiberg 49; Macoun, Selkirk Fl. 469; Chamberlain 175.

This plant in its typical form has all of the leaves falcate. It is not unusual for nearly all forms of the species to have some of the upper leaves falcate. Var. *falcata* grades into var. *alpicola* at one extreme and into *P. calcarea* at the other extreme.

10f. Var. *ADPRESSA* (Ferg.) Limp. Kryptfl. v. Schles. 1: 116. 1875.

Ph. adpressa Ferg.; Hunt in Mem. Lit. Phil. Soc. Manch. 5: 103. 1872. (in part) Limp. Laubm. 2: 574. 1895.

Ph. fontana var. *adpressa* (Ferg. ex parte) Loeske & Monkemeyer. Hedwig. 45: 209. 1906.

Stems loosely tufted, long and slender, often slightly lax, 4-10 cm. long, rather thick with leaves closely appressed or somewhat loosely clasping and parallel to the stem; leaves broadly ovate-acuminate to oblong-ovate, acuminate, the lower ones often obtuse, very concave, tips often incurved, costa broad, shortly excurrent or percurrent, ending below the apex in some of the lower leaves, lamina very plicate at the base, margin revolute at base, doubly serrate; upper cells usually shorter than in species, lower cells much enlarged, thin-walled and inflated, very lax. Sterile. Type locality, Scotland.

ILLUSTRATIONS:—Pl. 70 B; Dixon & Jam. Handb. Brit. Mosses, (Ed. 3) pl. 39-H; Braithw. Brit. Moss Fl. pl. 78-D; Monkemeyer, Laubm. Eur. 585, fig. 121e.

EXSICCATI:—Holz. Mosses of N. Western Montana 27a, Musc. Acro. Bor. Am. 78; Maxon 6301; Hawkins 1000r.

This variety has a parallel form in *P. caespitosa* var. *adpressa* which differs in the plane singly serrate margins of the leaves. It also resembles var. *borealis*, which has the leaves distant, parallel with the stem, very lax, the lower ones obtuse with the costa ending below the apex, tips often incurved and margins widely revolute and often singly serrate. All are associated with abundance of water, usually being long and slender, more or less flexuose and irregularly branched.

10g. Var. *BOREALIS* Hagen, Kongl. Norske Viden. 13. 1889.

Ph. borealis Limpr. Laubm. 2: 564. 1893.

Ph. tomentella var. *borealis* (Hagen) Loeske, Hedw. 45: 206. 1906.

Tufts thick, reaching 6 cm. high, the upper portion green, lower brownish and interwoven with loose tomentum; stems slender, mostly simple; leaves loosely clasping and parallel with the stem, very concave, ovate-acuminate to ovate-oblong, the lower obtuse with the costa ending below the apex; margins plane or widely recurved, singly serrate, often double below. Areolation very lax, cells usually large with large chloroplasts and thin walls, weakly papillose at the upper end. Sterile. Type locality, Norway.

ILLUSTRATIONS:—Möller, Ark. f. Bot. 19¹¹: 40, fig. 24; Pl. 70 L.

EXSICCATI:—No authentic specimens have been distributed under numbers. Specimens from Alaska, Canadian Rockies and Montana are to be found in various herbaria.

* Möller l. c. makes Bridel's var. *falcata* a synonym of *P. calcarea*. Evidently the name has been used by different authors for different plants.—A. J. G.

10h. Var. LAXA n. var.

Plantae longae et graciles, laxe caespitosae. Caules simplices vel innovando-ramosi. Folia remota, erecta vel dilatata, oblongo-ovata, breve acuminata; costa latissima, fusca, percurrentes vel breve excurrens; lamina plicata, margine revoluta, simpliciter vel dupliciter serrata. Cellulae laxissimae magnae, illis apicis extremi exceptis. Sterilis.

Plants long and slender in loose tufts, stems simple or irregularly branched; leaves distant and widely spreading or erect on the same stem, *oblong-ovate, shortly acuminate; costa very wide, indistinct at the edges, brown, percurrent or shortly excurrent; lamina plicate; margins revolute, especially above, or widely recurved at the base, singly or doubly serrate; areolation very lax, large and thin-walled cells reaching high into the lamina, only the extreme apex firm. Sterile. Type locality in District of Columbia, Holzinger. Pl. 70 C.*

10h¹. forma TENUIS n. forma.

Caules longissimi et tenues. Folia remotissima, appressa et laxiora.

Stems very long and slender, the leaves very distant and closely appressed, extremely lax. Pl. 70 D.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 661, as *P. fontana*, aberrant form (collection no. 6131).

The variety is usually dark green and is a parallel form of *P. caespitosa* var. *laxa*. The form is a long slender and spindling plant with very lax leaves. Both have been collected in New York, Pennsylvania and Colorado.

11. PHILONOTIS AMERICANA Dismier. Mém. Soc. Natur. Sci. & Math. Cherb. 36: 367-428. 1908.

Bryol. 14: 48. 1911.

Ph. glabriuscula Kindb. (in part) Macoun, Cat. Can. Plants 6: 107. 1892.

Plants robust in deep dense tufts, tomentose below; when dry the leaves often have a very characteristic appearance in diverging from the stem at a very wide angle while the upper portion curves upward and inward, the tips often spirally twisted, in straight rows. When moist the leaves are patent to erecto-patent, imbricated, green or yellowish-green; stems simple or with whorled branches, 3-10 cm. high. The leaves are broadly ovate, abruptly acuminate or ovate-lanceolate, with tips often twisted even when moist; costa stout, prominent at the back, reddish-brown, shortly excurrent; lamina deeply plicate, concave; margins revolute, doubly serrate; areolation firm, upper cells oblong-linear to rectangular, papillose at the upper ends, lower cells much larger and sometimes lax. Leaves of the male stems narrower, ovate-lanceolate, more evenly and gradually acuminate, less concave and plicate, appressed. Dioicous; perigonia large, bracts squarrose, base very broadly clasping, upper portion triangular-ovate, to oblong-lanceolate, the inner acute or obtuse; costa broad but faint, disappearing in the apex. Seta long, 2-4 cm. high, reddish-brown; capsules ovoid to subglobose, inclined or cernuous, 2-3 mm. long, reddish-brown, oblong and furrowed when dry; teeth reddish, cilia well developed, lid conic. Type locality, British Columbia.

ILLUSTRATIONS:—Pl. 70 F.

EXSICCATI:—All reported as other species, Holz. Musci Acro. Bor. Amer. 70b; Macoun, Can. Mosses 171a; Baker, Nev. Pl. 915; Standley & Bollman, N. M., 11081; Watson 1447; Allen 52; Nelson 6062.

A splendid plant easily recognized by its habit when dry and wide, deeply plicate leaves. It seems abundant in the Rocky Mountains and Canada, including the northern states and Alaska; Nova Scotia; Vermont.

11a. Forma LAXA n. forma. (*P. serrata* Kindb. in part.)

Plantae laxae caespitosae, lurido-virides. Caules longi, simplices vel irregulariter ramosi, graciliores, 3-8 cm. longi. Folia remota, patentia vel dilatata, laxa et mollia; folia inferiora concava, plicata, leve fibulata, oblongo-ovata, breve acuminata vel obtusata; costa lata et sub apice terminata.

Plants in very long loose tufts, stems simple or irregularly branched, 3-8 cm. long, dull green; leaves distant, patent to spreading, lax, the lower ones loosely clasping the stem and lying parallel with it, oblong-ovate, short-acuminate, concave and plicate, with margin revolute, the lower ones obtuse with the costa ending below the apex; areolation lax, the lower cells inflated. Sterile. Type locality, Selkirk, Canada. Type in Canadian Nat. Museum. Pl. 70 G.

EXSICCATI:—Can. Cryptogams 44.

The leaves of this variety are essentially like those of the species but very lax, distant and the stems long and more or less weak, often disarticulating at the innovations.

11b. Forma DIMORPHOPHYLLA n. forma.

Plantae caespitosae, rigidae. Caules graciliores, 2-4 cm. alti. Folia superiora forma speciei; folia inferiora appressa, concava, obtusa, costa lata sub apice terminata.

Plants strict, slender, 2-4 cm. high; leaves closely appressed except at the upper end, where they are patent. Most of the leaves obtuse with a broad costa ending below the apex, lax, upper tuft of leaves typical of the species. Type locality in Alaska, under snow banks in cold water. Pl. 70 K.

No authentic exsiccati have been issued but several specimens from Alaska and upper Canada are in various herbaria. This seems to be only a habitat form. The slender stems with closely appressed lower leaves apparently show the growth which took place early in the season when conditions were cold and snow or abundant water was present, while the thicker stem portion above with normal leaves represents the growth under more favorable conditions.

11c. Var. TORQUATA (Ren. & Geh.) Dismier, l. c.

Ph. Macounii var. *torquata* Ren. & Geh. Rev. Bryol. 23: 61. 1896.

Leaves strongly spirally twisted, deeply concave, often cucullate, strongly plicate, very broadly and shortly acuminate; costa wide; margins revolute, singly or doubly serrate; some lower leaves obtuse with the costa ending below the tip; areolation lax, the upper cells often very wide, 18-24 μ , lower cells inflated. Type locality, Washington. Pl. 70 H.

EXSICCATI:—Macoun 112, from Revelstoke, B. C.

The plant is apparently represented by four collections coming from the Cascade Mts. and Canadian Rockies. It is easily recognized by its habit and leaves.

11d. Var. GRACILESCENS Dismier, l. c.

Tufts dense, green, with long slender stems, and small short leaves.

Gaspé Co., Quebec. (Fide Dismier.)

No specimens were available for examination.

12. *PHILONOTIS CALCAREA (B. & S.) Schimp. Coroll. 86, 1856; Syn. (Ed. 2). 520. 1876.

Bartramia calcarea Bry. Eur. Fasc. 12, monogr. 19. 1842.

Plants very robust, much larger than the largest forms of Ph. fontana, becoming 12-15 cm. high, tufts usually loose but often compact, bright green or yellowish to pale, tomentose below; leaves large, lanceolate to oblong-lanceolate, the apex usually broadly acuminate, but often narrow, more or less regularly falcate, 2-3 mm. long; costa stout, shortly excurrent, margins revolute at least on one side; upper cells large, mostly oblong-linear, 10-15 μ wide, papillose at the lower ends. Dioicous; perigonal bracts oblong-lanceolate above the clasping base, acute to subacuminate, costa reaching the apex. Capsule as in Ph. fontana. Type locality European.

This plant is not definitely known in North America and the above description is included for convenient reference. Numerous collections have been referred to it but in all cases I have not been convinced that they actually represent this species. They are far too small, the structure of the leaves and the cells do not agree. In nearly every case they seem to be rather typical examples of *Ph. fontana*. About five or six plants have appeared in various herbaria that approach the plant but do not fit it adequately when compared with well authenticated European specimens. In order that these plants may be given a place in our flora I am erecting a new form to accommodate them properly.

Forma OCCIDENTALIS n. forma.

Habitus *P. fontanae*. Folia dense inserta, ovato-lanceolata, erecta vel falcata; costa angusta, longe vel breviter excurrent.

Plants smaller than the typical form, leaves mostly narrower and smaller, the apex usually longer pointed, the costa more slender and longer excurrent; upper cells smaller but usually larger than in *P. fontana*. Type locality Texas (Havard, no number). Type in the U. S. National Herbarium. Pl. 70 I.

EXSICCATI: Havard, Texas, two specimens without numbers.

* This description was drawn from well authenticated European specimens and is included for convenience.

DOUBTFUL SPECIES AND VARIETIES.

Philonotis fontana var. *alpina* Brid. Bryol. Univ. 2: 20. 1827. Two specimens seen that were referred to this variety belong in var. *adpressa*.

P. fontana var. *brachyphylla* Kindb. Macoun Cat. Can. Pl. 6: 107. 1892 and var. *microblasta* Kindb. l. c. are rather small forms of the species without plicate leaves, but otherwise within the range of variation of the species.

P. fontana var. *pumila* Kindb. Eur. & N. A. Bryin. 328. 1897 is a slender form very close to var. *adpressa*.

P. fontana var. *compacta* Schimp. Syn. (Ed. 2) 220. 1876. American plants seen that have been referred to this variety are habitat forms of var. *pumila*.

P. caespitosa var. *heterophylla* Dismier, Mém. Soc. Nat. Sci. & Math. Cherb. 36: 367-428. 1908. Two specimens seen are apparently habitat forms closely related to var. *laxa*.

Family MEESIACEAE.

Plants of wet boggy places, often growing with *Sphagnum*, slender to robust; stems with central strand, radiculose, radicles often papillose; leaves mostly spreading to squarrose from an erect base, ovate-lanceolate to narrowly elongated-lanceolate; costa strong, usually ending a little below the apex; leaf cells small, smooth (except *Paludella*) and thick-walled (except *Amblyodon*). Seta usually long and slender; calyptra smooth, cucullate; capsules clavate to long-pyriform, curved, mostly subarcuate when dry, with a long and conspicuous neck, smooth or slightly and irregularly wrinkled when dry but not contracted below the mouth; operculum small, short-conic, often apiculate; annulus present; peristome double, the inner of 16 narrow, linear-lanceolate segments from a basal membrane of variable height, sometimes connected by fine transverse filaments; cilia lacking or rudimentary; teeth much shorter (except *Paludella*), truncate and obtuse; spores very large (except *Paludella*).

All our species are rare or infrequent and northern in range. *Amblyodon* has the leaves of a *Funaria* but the sporophyte of a *Meesia*.

KEY.

- | | |
|---|-----------------------|
| 1. Leaves strongly squarrose-recurved; leaf cells strongly mamilllose; peristome teeth and segments of equal length | 1. <i>Paludella</i> . |
| Leaves not recurved, smooth; peristome teeth much shorter than the segments | 2. |
| 2. Leaf-cells large and thin-walled as in <i>Funaria</i> | 2. <i>Amblyodon</i> . |
| Leaf cells (upper) small and thick-walled | 3. <i>Meesia</i> . |

1. PALUDELLA [Ehrh. 1788] Brid. Sp. Musc. 3: 74. 1817.

Plants tall, deeply tufted, densely tomentose; leaves 5-seriate, decurrent, squarrose-recurved, hook-like, strongly mamilllose. Monotypic.

PALUDELLA SQUARROSA (L. Hedw.) Brid. l. c.

Bryum squarrosus Hedw. Sp. Musc. 186. 1801.

Orthopyxis squarrosa P. B. Prodr. 72. 1805.

Plants in bright yellow-green dense tufts or sods, brown to black below, 5-15 cm. high; stems rather stout, little branched; leaves crowded, strongly squarrose-recurved from an erect base, broadly ovate-lanceolate, reaching 2 x 1 mm., acutely keeled, acute, little changed when dry; margins narrowly recurved on the spreading part of the lamina, densely serrate above; costa well developed, vanishing below the apex; basal leaf cells narrowly rectangular, 10-15 x 60-100 μ , hyaline, those above becoming rounded-hexagonal, smaller, 12-16 μ , incrassate, strongly mamilllose (that is, each cell with a single large central blunt papilla) on both sides and on the back of the costa, the marginal rhomboidal and projecting as teeth; perichaetial leaves spreading, not recurved, long-lanceolate, reaching 0.9 x 3.6 mm.; perigonal leaves not recurved, upper cells more elongated. Dioicous; seta reddish, 5-10 cm. long; capsule broadly oblong, with a short thick neck, brown, smooth even when dry (except the neck), somewhat curved to almost arcuate, with operculum about 4 x 1 mm.; operculum conic-apiculate; annulus double; peristome with perfect teeth and segments of equal length, cilia lacking; spores 14-20 μ , in summer. Type locality, Germany.

ILLUSTRATIONS:—Hedw. Sp. Musc. *pl.* 44, *f.* 6-10; Bry. Eur. *pl.* 312; Braithw. Brit. Moss Fl. 2: *pl.* 79B; Limpricht, Laubm. 2: 500, *f.* 306; *Pl.* 63.

EXSICCATI:—Drumm. Musc. Am. 248; Aust. Musc. Appal. Suppl. 520; Holz. Musc. Acro. Bor. Am. 244.

Infrequent and local in cool bogs, more frequent in arctic-alpine regions. Alaska to Greenland; south to Vermont, New York, Wyoming and the Rocky Mts. A very striking and unmistakable species.

2. AMBLYODON P. B. Prodr. 35. 1805; emend. Bry. Eur. fasc. 10. 1841.

Plants short and slender, in low loose green tufts; stems radiculose at base only; radicles papillose; leaves larger above, thin, soft and little twisted when dry, resembling those of *Funaria*. Monotypic.

AMBLYODON DEALBATUS P. B. l. c. 41.

Meesia dealbatus [Dicks.] Hedw. Sp. Musc. 174. 1801.

Stems 1-3 cm. high, nearly simple, red below with age; leaves more or less crowded at the upper end of the stem, long ovate-lanceolate to oblong-lanceolate, pale green, erect-spreading when moist, somewhat shrunk when dry, 2.5-3.5 mm. long, gradually to rather abruptly acute; margins plane, entire, or serrate at apex in the upper leaves only; costa very strong, sometimes $\frac{1}{2}$ the width of the leaf at the base, narrowing above and ending well below the apex; leaf cells large, thin-walled, narrower at the margins; the lower long-rectangular, upper shorter, 20-30 μ wide, 60-100 μ long, oblong-hexagonal to rhombic-hexagonal, smooth; perichaetial leaves little different. Autoicous and polyicous; seta 2-5 cm. long; capsule pale-brown, darker with age, elongate-pyriform, with operculum 3 mm. long, curved, with erect neck $\frac{3}{8}$ the length of the urn, arcuate when dry but nearly smooth; operculum conic, obtuse; annulus simple; peristome teeth 16, variable in length, 0.12-0.18 mm. high, obtuse, often not more than $\frac{1}{2}$ the length of the segments; segments linear-lanceolate, carinate and more or less perforate along the keel, nearly smooth, sometimes connected by fine transverse filaments; cilia lacking; spores 35-45 μ , rough, late spring to summer. Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl.* 307; Hedw. l. c., *pl.* 41, *f.* 6-9; Limpr. Laubm. 2: 504, *f.* 307; Braithw. Brit. Moss Fl. 2: *pl.* 64B; *Pl.* 63.

EXSICCATI:—Drumm. Musc. Am. 249; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 243.

Wet springy places, often calcareous, alpine to subalpine; rare. Alaska to Nova Scotia and Gaspé; south in the Rocky Mts. to Colorado; Wisconsin.

Var. AMERICANUS R. & C. Bull. Herb. Boiss. 4: 13. 1896.

Plants smaller; stems about 1 cm. high; leaves rather more sharply serrate; neck of capsule almost as long as the urn; peristome teeth often more slenderly pointed; segments longer, reaching 0.3 mm., papillose, sometimes nodulose above. Type locality, "trickling shaded limestone cliff along St. Croix River, Osceola, Minnesota" (Holzinger).

The type collection has been studied; in one peristome some segments were nodulose as originally described, others were not; some teeth were longer and slenderly pointed, others were obtuse.

EXSICCATI:—R. & C. Musc. Am. Sept. 180; Grout, Musci Perfecti 276 (Climax, Michigan, Becker).

3. MEESIA Hedw. Fund. 2: 97. 1782; Sp. Musc. 173. 1801.

Plants loosely or densely tufted, densely tomentose, green to yellowish-green above, brown to blackish below; leaves decurrent, rather distant, suberect to widely spreading, smooth, oval-oblong to linear-lanceolate; costa strong, vanishing below the apex; upper leaf cells hexagono-rectangular, small; basal elongated, rectangular and hyaline; capsule and peristome like *Amblyodon*; short cilia sometimes present; segments sometimes connected by transverse nodulose filaments. Type species, *M. longiseta*.

Named after the Dutch gardener, David Meese, but Hedwig spelled the generic name *Meesia*.

KEY.

- | | |
|--|-----------------------|
| 1. Leaf margins plane..... | 2. |
| Leaf margins revolute..... | 3. |
| 2. Leaf margins, with few exceptions, entire; synoicous..... | 1. <i>longiseta</i> . |
| Leaf margins strongly serrate; dioicous..... | 4. <i>triquetra</i> . |

3. Costa thick, up to $\frac{1}{2}$ leaf base; leaf apex lingulate; plants polygamous. 3. *uliginosa*.
 Costa narrow, about $\frac{1}{7}$ leaf base; leaf apex acute to narrowly obtuse; monoicous. 2. *hexasticha*.

1. *MEESIA LONGISETA* Hedw. Stirp. Crypt. 56. *pl.* 21 & 22. 1787; Sp. Musc. 173. 1801.

Amblyodon longisetus P. B. Prodr. 41. 1805.

Plants densely to loosely tufted, 4–10 cm. high; stems nearly simple, densely radiculose, larger radicles papillose; leaves rather distant, shriveled when dry, when moist spreading from a suberect base, ovate-lanceolate, oblong-ovate, or oblong-lanceolate, varying a great deal in outline, 2.5–3.5 mm. long, decurrent, acute or narrowly obtuse; margins plane and entire, or rarely slightly toothed at the apex; costa strong, vanishing below the apex; upper leaf cells rectangular to rhombic-hexagonal, thin-walled, about $15\ \mu$ wide, 2–4 : 1; basal cells elongated-rectangular, 14–20 x 30–65 μ , narrower on the margins; perichaetial leaves long-lanceolate from an oblong base, reaching 5 mm., with longer cells.

Synicous; seta up to 10 cm. long; calyptra conic-cylindric, about 4 mm. long; capsule curved and inclined, thin-walled, elongate-pyriform, with neck nearly as long as urn, reaching 5 mm. in length over all; peristome yellow, structure as figured; segments strikingly nodose, short cilia often present; spores 32–45 μ , in summer. Type locality, near Berlin, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl.* 308; Monkem. Laubm. Europ. 573. *f.* 117a; Husnot, Musc. Gall. *pl.* 72; *Pl.* 65.

EXSICCATI:—Sull. Musc. Allegh. 108; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 161, (Ed. 2) 244; Aust. Musc. Appal. Suppl. 519.

Deep swamps and Sphagnum bogs, New Brunswick, Massachusetts, New York, Ontario, Ohio, Idaho, British Columbia, Greenland (Fl. Gr.). Very local and rare except in a few localities.

Var. *MACOUNII* Kindb. Rev. Bryol. 40: 36. 1905, is a form with the costa short-excurrent in a few of the upper perichaetial leaves; leaf margins, especially of the perichaetial leaves, often somewhat reflexed in the middle. This rarely occurs to a slight degree in otherwise normal forms of the species and has occasionally led to a confusion with *M. hexasticha* which has the leaf margins almost as strongly revolute as in *M. uliginosa*. It has been found in the Yukon (type locality) and in Alberta, both by Macoun; cranberry bog, Illinois, in herb. Canadian Nat. Museum.

2. *MEESIA HEXASTICHA* (Funck) Monkem. Laubm. Europ. 572. 1927.

Diplocomium hexastichum Funck, Moost. 43. *pl.* 27. 1820.

Meesia hexagona Albert in Brid. Bryol. Univ. 2: 68. 1827.

Meesia Albertinii Bry. Eur. *pl.* 310. 1841.

This can not better be described than in the language of the Bryologia Europaea (translated). Habit, arrangement of leaves and form of *M. longiseta*, yet lower and intermediate between *M. longiseta* and *M. uliginosa*. Distinguished by the revolute leaf margins, capsule shorter and peristome teeth very short (0.9 μ), irregular; annulus lacking, monoicous with antheridia and archegonia in separate buds; spores in spring, 35–40 μ .

The leaves are much wider at base and the costa much narrower, especially near the apex, than in *uliginosa*. The revolute leaf margins and blunter leaf apices as well as the shorter peristome mark it off from *longiseta*. Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl.* 310; Husnot, Musc. Gall. *pl.* 72; *Pl.* 64.

EXSICCATI:—Rocky Mts.; Illinois, Vasey (in herb. U. S. National Museum as *M. longiseta*). Very rare. In Europe it is confined to the central regions so that its occurrence in Illinois is not surprising. It would seem from the material at hand that the plants first bear antheridial buds at the top and later archegonial buds from innovations, apparently at a later year.

Vasey's Illinois plants are very definitely *M. hexasticha* and they are the only ones thus far seen from N. America. Three sets of Drummond's 244 at the New York Botanical Garden are *M. triquetra*. A specimen from Labrador (Waghorne) det. Kindberg, in the same herbarium contained not a scrap of any *Meesia*. As *M. hexasticha* is distinctly not an arctic-alpine plant in Europe, its occurrence at high altitudes or latitudes in N. America may be doubted.

3. MEESIA ULIGINOSA Hedw. l. c. & Sp. Musc. 173. 1801.

Meesia trichodes [L.] Spruce in Ann. & Mag. Nat. Hist. (2nd ser.) 3: 369. 1849.

Plants 1-4 cm. high, occasionally taller, heavily radiculose with strongly papillose radicles; leaves linear-ligulate or lanceolate-ligulate, sometimes from a wider ovate base, especially the upper and perichaetial leaves, mostly *broadly rounded-obtuse at apex*, rarely subacute, 2-3 mm. long, erect, *shining and little contorted when dry, scarcely decurrent; margins entire and strongly revolute; costa very strong*, occupying $\frac{1}{3}$ - $\frac{1}{2}$ the width of the leaf at base and very broad also at its upper end, usually ending several cells below the apex (rarely percurrent); upper leaf cells much as in *M. longiseta* but often little longer than broad at apex above the costa; perichaetial leaves usually longer and broader at base. Monoicous or polygamous; seta 1-7 cm. long; capsule light brown, darker with age, usually smaller and more strongly curved than in the two preceding species; annulus simple; peristome meesoid as figured; spores 40-50 μ , in summer. Type locality, Germany.

ILLUSTRATIONS:—Bry. Eur. *pl.* 308; Husnot, Musc. Gall. *pl.* 72; Braithw. Brit. Moss Fl. 2: *pl.* 79; *Pl.* 64.

EXSICCATI:—Drumm. Musc. Am. 247; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 164; Aust. Musc. Appal. Suppl. 518; Holz. Musc. Acro. Bor. Am. 412; R. & C. Musc. Am. Sept. 375; Macoun, Can. Musci 156, 420; Grout, Musci Perfecti 78.

Cold bogs and wet fissures in mountain ledges; not rare but infrequent and local. Alaska to Labrador, south to California, Colorado, Minnesota and New York.

3a. Var. MINOR (Brid.) Bry. Eur. fasc. 10. 1841.

Meesia minor Brid. Bryol. Univ. 2: 62. 1827.

Plants much reduced, scarcely 1 cm. high; leaves small, linear-lanceolate, obtuse; costa almost percurrent; seta 1-2 cm.; capsule very short, about 2 mm. long, relatively thicker; an alpine form. A specimen from Nevada, 10,000 ft., Watson, 1444, 1868, has stems scarcely 2 mm. long. White Mts. New Hampshire; marshes in the Rocky Mts. (Drummond); Greenland. *Pl.* 64.

EXSICCATI:—Drumm. Musc. Am. 246.

3b. Var. ALPINA (Funck) Bry. Eur. l. c.

In dense tufts; leaves narrower, acute to subacute, strict or somewhat secund. Alpine or subalpine. *Pl.* 64. Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 164b, White Mts. Oakes; Rocky Mts. Differs from the preceding variety in its larger size and acute leaves. *Pl.* 64.

4. MEESIA TRIQUETRA (L., Hook. & Tayl.) Aongstr. in Nov. Act. Soc. Upsal. 12: 357. 1844.

Bryum triquetrum Hook. & Tayl. Musc. Brit (Ed. 1) *pl.* 28. 1818.

Diplocomium tristichum Funck, Moos-Tasch. 43. *pl.* 27. 1820 (in part).

Meesia tristicha Bry. Eur. fasc. 10. 1841.

Plants rather loosely cespitose, reaching 10-15 cm. in height, dark green, young shoots lighter, brown to black below; stems with dark papillose radicles below, sparingly branched; leaves 3-ranked, usually distant, 2-3 mm. long, broadly ovate-lanceolate, from a subclasping decurrent erect base squarrose-spreading, strongly contorted with incurved apices when dry, carinate; margins plane, sharply serrate above as a rule; costa strong, nearly percurrent to shortly excurrent; perichaetial leaves longer, up to 6 mm., narrowly linear-lanceolate above; upper leaf cells rectangular to hexagonal above, slightly incrassate, $\pm 4 \mu$ wide, 1-3 : 1, longer in the perichaetial leaves; basal cells larger, thin-walled, oblong-rectangular, reaching 90 μ in length. Dioicous; male heads discoid; seta 8-10 cm. long; capsule elongated-pyriform, curved, with an upright neck as long as the urn, 4-6 mm. over all; neck shrunken and urn nearly horizontal when dry; annulus double; peristome with very short outer teeth; segments long slender and nodose, often bordered by nodose filaments*; cilia 3 short; spores 30-40 μ , in summer. Type locality, European.

ILLUSTRATIONS: Drumm. Musc. Am. 244; Bry. Eur. *pl.* 311; Limpr. *Laubm. 2: 515, f. 308; Husnot, Musc. Gall. *pl.* 72; M. H. M. *pl.* 42.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 163, (Ed. 2) 216; Aust. Musc. Appal. 217; R. & C. Musc. Am. Sept. 297; Holz. Musc. Acro. Bor. Am. 345; Macoun, Can. Musci 157, 433 & Can. Mosses 168.

Bogs and wet woods. Alaska to northern Greenland, south to Washington, California, Alberta, British Columbia, Lake Superior region, Ohio, Pennsylvania and New Jersey. Not reported from the Rocky Mts. of the U. S. Infrequent and local.

Family BRYACEAE.

By A. LeROY ANDREWS, Ph.D.

Perennial plants, usually associated in greater or smaller tufts, rarely growing separately among other mosses. Stem short to several cm. in length, erect, often matted with radicles in lower part, simple or somewhat branching, especially by subfloral innovations, round to pentagonal in section, normally with central strand and a cortex of thick-walled mostly pigmented cells. Leaves lanceolate or linear-lanceolate to ovate to obovate, rarely oval or nearly round, smaller at base of stem and gradually increasing in size upward, frequently distinctly tufted above; perichaetial leaves not greatly differing from the others. Costa always present, extending to middle of leaf or usually above, frequently percurrent or excurrent, generally strong and with a normal section. Blade of leaf of a single layer of cells, except that the border when present is rarely thickened; cells in basal part of leaf rectangular, in upper part of leaf prosenchymatic, rhombic to rhomboidal-hexagonal, in some cases narrower to linear or even vermicular.

Inflorescence terminal, dioicous or monoicous in various arrangements, paraphyses when present filiform. Seta generally strong and more or less elongated so that capsule is always free from gametophyte. Capsule rarely erect, sometimes inclined or horizontal, generally pendent, from clavate to pyriform to oval or almost spherical, with a more or less prominent neck. Calyptra cucullate, generally small and fugacious. Stomata rather numerous, confined to the neck portion of capsule. Peristome normally double and complete, in some cases either the inner or outer peristome incomplete or lacking entirely. Spores mostly small, round or nearly so.

The family is a very natural one, representing the end of a line of development from an ancestry not clearly demonstrable from forms now living. Mniaceae is apparently the most closely related family, but representing only a parallel development, neither family being a direct (or indirect) derivative of the other. The forms with imperfect peristomes are apparently so by reduction and represent secondary developments rather than primitive types. As has been noted by others, the species may perhaps best be understood as constituting a single large natural genus (*Bryum*), but pending a thorough revision of the family in its world-wide distribution, I have felt it desirable to retain provisionally some of the established grouping, based upon conditions of peristome and leaf-areolation. I have, doubtless somewhat subjectively, tried in the first place to keep separate two groups of genera, Pohlloideae and Bryoideae, the former distinguished especially by narrower leaf-cells, together with for the most part lack of differentiated leaf-border and a tendency toward denticulation of leaf-edge; the cilia of inner peristome when present very rarely appendiculate. Some exceptions will be found on both sides to all of these distinctions. I should conceive of the Pohlloideae as more primitive than the Bryoideae.

KEY TO GENERA.

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|---|----------------------------|
| 1. Leaf cells usually elongated, 4 : 1 or longer..... | 2. (POHLLOIDAE). |
| Leaf-cells usually broader, less than 4 : 1..... | 5. (BRYOIDAE). |
| 2. Outer peristome lacking..... | 1. <i>Mielichhoferia</i> . |
| Outer peristome present..... | 3. |
| 3. Inner peristome without basal membrane, composed of separate more or less rudimentary teeth..... | 2. <i>Orthodontium</i> . |
| Peristome more perfect..... | 4. |
| 4. Leaves very narrow, linear-lanceolate, costa broad..... | 3. <i>Leptobryum</i> . |
| Leaves broader, with narrow costa..... | 4. <i>Pohlia</i> . |
| 5. Inner peristome consisting of a basal membrane without definitely differentiated segments..... | 5. <i>Brachymenium</i> . |
| Inner peristome with segments..... | 6. |
| 6. Outer peristome teeth shorter than inner ones..... | 6. <i>Plagiobryum</i> . |
| Outer peristome teeth not shorter than inner ones..... | 7. |
| 7. Capsules single, not more than one to a perichaetium..... | 7. <i>Bryum</i> . |
| Plants robust, capsules often two or more to a perichaetium..... | 8. <i>Rhodobryum</i> . |

1. MIELICHHOFERIA Hornsch. Bryol. Germ. 2: 179. 1831.

Plants erect, closely matted in extensive tufts, often much elongated, with felt of rhizoids below, or even extending well up the tufts; leaves lanceolate to ovate, sometimes denticulate above, margin plane or somewhat reflexed; costa rather strong, normally percurrent; cells of leaf-blade somewhat narrow, linear-

rhomboidal, 5 or more times as long as wide, with thicker or thinner walls. Dioicous so far as our species are concerned, but often with both ♂ and ♀ plants in the same tuft, so that capsules are frequently present and may even be numerous. Inflorescence, both ♂ and ♀, terminal on very short branches, which appear lateral, being overtopped by growth of other branches. Seta strong, of various lengths. Capsule normally more or less elevated above vegetative tufts, horizontal to erect, pyriform; operculum flattened or convex, mamillate; annulus well developed; outer peristome lacking; inner inserted near mouth of capsule, with low basal membrane and 16 linear segments, which are not perforated, but show a weak longitudinal line of division and several fairly prominent transverse bars. Type species, *M. Mielichhoferiana*.

KEY.

- Leaves denticulate above, their cells thick-walled..... 1. *Mielichhoferiana*.
 Leaves entire above, their cells thin-walled..... 2. *macrocarpa*.

1. MIELICHHOFERIA MIELICHHOFERIANA (Funck) Limpr. Laubm. 2: 208. 1891.

Weisia Mielichhoferiana Funck; Hornsch. in Flora 2: 86. 1819.

Oreas Mielichhoferi Brid. Bryol. Univ. 1: 381. 1826.

Mielichhoferia nitida Hornsch. Bryol. Germ. 2²: 183. pl. 41, f. 1. 1831.

Plants erect in dense tufts of a yellowish-green color on the surface, interior of tufts brown and matted with radicles below; stems somewhat branching, in Europe growing up to 2 or 3 cm. in length, in our specimens shorter; leaves erect, stiff, subimbricate when dry, lanceolate, denticulate in apical part, margin plane or nearly so; costa fairly strong, usually percurrent; leaf cells thick-walled, linear-rhomboidal, up to $10 \times 100 \mu$ or more; at base several rows of square or short rectangular cells. Dioicous: ♂ inflorescence gemmiform, terminal on short lateral branch; ♀ inflorescence on similar lateral branch. Seta in our specimens hardly reaching 1 cm. high, flexuose, brownish yellow, becoming brown with age; capsule erect to slightly inclined, yellowish green, becoming brown with age, generally not completely symmetrical, but slightly bent to one side; neck not so long as rest of capsule; mouth of capsule rather large in our specimens; operculum fairly large, rounded-convex, slightly mamillate at apex, marked off by a reddish brown ring at its junction with the capsule; annulus of two rows of large cells, removable; cells of exothecium tending to be rectangular, slightly longer than broad, shortened markedly in 3 darker pigmented rows at mouth of capsule; peristome (endostome) yellow, of 16 slender, somewhat irregular, linear segments, confluent in low basal membrane; spores around 15μ , round, brownish yellow, with slightly granular roughened surface. New capsules were approaching maturity, but had not yet cast off the opercula when collected in August. Type locality, Alps in Austria.

ILLUSTRATIONS:—Bry. Germ. l. c.; Bry. Eur. pl. 328; Pl. 71.

EXSICCATI:—Grout, Musci Perfecti 283.

On rocks, south shore of Lake Superior, at Pictured Rocks, Alger County, Michigan, where the first American collection of this species was made by Prof. Geo. E. Nichols in August, 1933. In Europe found in widely scattered localities, extending to the Caucasus.

2. MIELICHHOFERIA MACROCARPA (Drumm.) Br. & Sch. Lond. Journ. Bot 2: 665. 1843.

Weissia macrocarpa Drumm. Musc. Am. 74. 1828.

Mielichhoferia Porsildii Hagen, Meddel. om Grönland 26: 437. 1904.

Plants erect in dense tufts, closely matted with radicles, green on surface, brown to somewhat reddish within; stem fastigiate branching, up to 15 mm. in length; leaves erect, loosely spreading to subimbricate, somewhat flexuose when dry, ovate to ovate-lanceolate, margin more or less recurved, entire; apex obtuse to acute or even slightly acuminate (var. *pungens* of *Bartram); costa fairly strong, normally percurrent; cells of leaf-blade thin-walled, linear-rhomboidal, up to $15 \times 80 \mu$, broader toward costa, narrower toward margin, shorter and rectangular in basal part.

Dioicous: both ♂ and ♀ inflorescences on short lateral branches. Seta erect, flexuose, short, hardly exceeding 5 mm., tawny brown; capsule light-brown, small, short-pyriform, symmetrical, horizontal to subpendent, neck short; operculum rather small, very slightly convex, with minutely mamillate tip; annulus prominent, of two rows of cells, persistent; peristome single (endostome), of 16 pale linear segments, from a low basal membrane; spores about 15μ in diameter, surface granular-roughened.

Type locality, Canadian Rockies.

ILLUSTRATIONS:—Meddel. om Grönl. 26: pl. 10; E. B. Bartram, * Bull. Torrey Bot. Club 54: 32. f. 1-15 (1-13 var. *pungens*); Pl. 71.

EXSICCATI:—Drumm. Musc. Am. 74.

On rocks, Disco Island of western Greenland, Arctic America, southward in Rocky Mts. to Colorado.

2. ORTHODONTIUM Schwaegr. Suppl. 2^o: 123. 1827.

Stableria Lindb. Utkast Nat. Grupp. 20. 1878.

Plants small and delicate, yellowish-green, hardly exceeding 5 mm. in height, erect, simple or slightly branching, radiculose only at base; leaves densely arranged and long in relation to the size of plants, erect, flexuose, linear-setaceous to narrowly ovate or obovate-lanceolate; margin plane, entire or nearly so; costa narrow, percurrent or nearly so to somewhat excurrent; cells of leaf-blade linear-rhomboidal except in base of leaf, where they are rectangular; inflorescence paroicous or autoicous, in latter case antheridia on a small gemmiform branch, regularly fruiting. Seta slender, erect, up to 8 mm. high in our species; capsule suberect, clavate or subcylindrical to ovate-pyriform, with longer or shorter neck, smooth or slightly sulcate when dry; operculum rather prominent, with a short beak; annulus lacking; peristome double, inserted below mouth of capsule, exostome of 16 rather slender fragile teeth, smooth or slightly papillose; endostome without basal membrane, of 16 similarly slender segments, shorter than or of equal length with the outer peristome teeth; spores small, round. Type species, *O. lineare* Schwaegr.

The creation of a genus *Stableria* by Lindberg was apparently based on a misunderstanding (Cf. Bryologist 35: 50. 1933) and as employed by Brotherus in Engler & Prantl attempts to separate species which are very clearly congeneric. The species referred to both these genera are all closely related and probably reducible to a very few.

KEY.

1. Paroicous; leaves narrowly linear-setaceous; capsule subcylindric. 1. *gracile*.
- Autoicous; leaves broadening above base, obovate-lanceolate; capsule ovate-pyriform. 2. *pellucens*.

1. ORTHODONTIUM GRACILE (Wils.) Schwaegr. in litt.; Bry. Eur. fasc. 23-24. pl. 330. 1844.

Bryum gracile Wils. Smith & Sowerby, Suppl. Eng. Bot. 3: pl. 2835. 1839.

Stableria gracilis Lindb. Utkast 20. 1878.

Plants generally closely tufted into extensive mats, mostly erect and unbranched, hardly exceeding 5 mm. in height, yellowish to brownish green; leaves erect-spreading, flexuose, closely tufted, long linear-setaceous; margin plane, slightly denticulate toward apex; costa strong, percurrent to slightly excurrent; cells of leaf-blade narrowly linear, with rather thick walls, up to $8 \times 70 \mu$ or longer, at base shorter, rectangular, thinner-walled, hyaline and brownish. Inflorescence paroicous, antheridia in axils of comal leaves; seta slender, erect, yellowish, up to 8 mm. high; capsule erect to slightly inclined, clavate or subcylindric, with a long neck nearly as long as rest of capsule to operculum, pale in color, thin-walled, not sulcate on drying; exothecial cells thin-walled, elongated, shortened in about 8 rows at mouth of capsule; stomata phaneropore with elliptical pore about 8μ in length; operculum long, somewhat oblique, beaked; peristome inserted well below mouth of capsule; outer teeth notably longer than inner segments, slender, not papillose, very light yellowish-hyaline, dorsally divided by a longitudinal line and transverse lines, ventrally with somewhat distant prominent lamellae, teeth broadening at lamellae; inner peristome segments very slender and fragile, cilia-like, short, hyaline, not papillose; spores $15-20 \mu$, round or nearly so, brownish yellow, papillose. Type locality, England.

ILLUSTRATIONS:—Smith & Sowerby, l. c.; Bry. Eur. l. c.; Braithw. Brit. Moss Fl. 2: pl. 66B; Pl. 72.

On charred or otherwise decaying wood, California in redwood areas. In Europe also on sandstone rock, only in Great Britain and northwestern France.

2. ORTHODONTIUM PELLUCENS (Hook.) B. & S. Bry. Eur. fasc. 23-24. 1844.

Bryum pellucens Hook. Ic. Pl. 1: pl. 34. 1837.

Stableria gracilis var. *californica* M. A. Howe, Erythaea 5: 92. 1897.

Plants closely tufted in extensive mats, yellowish-green, simple or slightly branching, up to 8 mm. in height; leaves spreading, flexuose, narrowly obovate-lanceolate, broadest at about $\frac{2}{3}$ distance from base to

apex; margin plane, entire or very nearly so; costa rather slender, generally ceasing somewhat below acute apex; cells of leaf-blade narrowly linear-rhomboidal or somewhat vermicular, thick-walled, up to $8 \times 100 \mu$ and longer, at base shorter and broader, thin-walled, rectangular, brownish. Inflorescence autoicous, antheridia in a small gemmiform branch from lower part of stem. Seta terminal, slender, erect, brownish yellow, up to about 1 cm. long; capsule erect or somewhat inclined, ovate-pyriform with a relatively short neck, pale brown, dark at mouth, tending to become somewhat furrowed on drying; exothecial cells thin-walled, not elongated, somewhat irregular in shape, those at mouth differentiated in only 4 or 5 rows, the last two rows with thicker walls and dark pigmentation; stomata as in the other species; outer peristome teeth about as long as inner segments, if the latter are not broken, both rough (papillose); inner peristome segments somewhat irregular in outline, fragile; spores around 15μ . Type locality, Colombia (So. America). *Pl.* 72.

Known in our area only from a charred redwood stump, near Eureka, California, where it was collected by M. A. Howe in 1896. It occurs also in the West Indies, Central and South America. In recent years analogous forms have been found in isolated localities in England, France and Spain and interpreted variously as a variety of *O. gracile* or a new species of *Orthodontium*. Our two types certainly differ in too many respects to be regarded as conspecific. Mrs. Britton in her studies of the genus in America seems from herbarium notes to have concluded that *O. arenarium* C. M., *O. confine* Hpe., *O. Fendleri* C. M. and *O. Ulei* C. M., all from South America, are reducible to *O. pellucens*, which antedates them, but that *O. longisetum* Hpe. and *O. denticulatum* Geh. & Hpe., likewise from South America, might on the basis of smooth endostome segments be distinct.

3. LEPTOBRYUM (B. & S.) Schimp. Coroll. 64. 1855.

Bryum subg. *Leptobryum* B. & S. *Bry. Eur. fasc.* 46-47. 1851.

Plants loosely to closely tufted, light or yellowish-green, simple, generally short, but sometimes elongated; leaves very narrow, setaceous, with broad flattened excurrent costa; cells of leaf-blade linear, very long and narrow, in basal part shorter and broader. Normally synoicous, with abundant capsules; capsule inclined to pendent, rather small, shining light brown, pyriform with fairly long neck; operculum hemispherical; peristome complete; inner with high basal membrane, segments with median gaps, about same length as teeth of outer peristome; cilia normally in 3's, of same length as segments, appendiculate. Type species, *L. pyriforme*.

This genus, probably best regarded as monotypic, though a few other species have at various times been included in it, is in some respects the most distinct of the Bryaceae.

LEPTOBRYUM PYRIFORME (L.) Schimp. Coroll. 64. 1855.

Mnium pyriforme L. *Spec. Plant.* 1112. 1753.

Webera pyriformis Descr. 1: 5 *pl.* 3. 1787.

Plants loosely or closely tufted, erect; living part of stem generally not more than 1 cm. high, radiculose at base, where new shoots arise; stem with strong central strand; leaves, especially uppermost ones very long and narrow, linear-setaceous, erect-spreading, more or less flexuose when dry; margin plane, denticulate in upper part; costa unusually broad, occupying nearly all of leaf, shown by section to be flattened and passing gradually on either side into blade in basal part of leaf only; the costa shows several large median guide-cells; cells of blade long linear. Inflorescence terminal, normally synoicous and producing abundant capsules. Seta slender, often elongated, up to 3 cm. or more, reddish- or brownish-yellow, flexuose; capsule horizontally inclined to pendulous, light to darker brown, lustrous, somewhat small, neck proportionately long, much contracted in drying while spore-bearing part of capsule remains uncontracted, plump and oval, mouth proportionately large; calyptra long-beaked; operculum hemispherical, slightly mamillate; walls of capsule thin; exothecial cells somewhat irregular in size and shape, thin-walled, abruptly shortened in about 5 rows at mouth of capsule; stomata numerous, small, phaneropore, even somewhat protruding from surface of capsule; peristome double, complete, inserted somewhat below mouth of capsule; outer teeth broad below and long, yellow, papillose, with numerous closely placed lamellae; inner peristome with high basal membrane, hyaline, papillose, segments fenestrate with broad openings, cilia in 3's, appendiculate; spores round, brownish, papillose, about 15μ . Sterile plants sometimes bear purplish gemmae on stems or protonema. Type locality, Europe.

ILLUSTRATIONS:—*Bry. Eur. pl.* 355; *Limpr. Laubm.* 2: f. 266; *M. H. M. f.* 105; *Pl.* 76.

EXSICCATI:—*Drumm. Musc. Am.* 271; *Sull. Musc. Allegh.* 103; *Aust. Musc. Appal.* 184; *Sull. & Lesq.*

Musc. Bor. Amer. (Ed. 1) 183, (Ed. 2) 276; Holz. Musc. Acro. Bor. Amer. 113 & 113b; Ren. & Card. Musc. Am. Sept. 301; Grout, Musci Perf. 9.

The plant grows on earth and other substrata, is of general, apparently cosmopolitan distribution, is often found as a weed about greenhouses, etc.

4. POHLIA Hedw. Descr. 1: 69, *pl.* 36. 1787.

Webera Hedw. Fund. 2: 95. 1782. Not *Webera* Ehrh. Hann. Mag. 1779: 257.

Trentepohlia Roth, Usteri, Ann. Bot. 10: 52. 1794.

Anomobryum Schimp. Syn. 382. 1860.

Epipterygium Lindb. Öfvers. K. Vet.-Ak. Förh. 19: 599. 1863.

Mniobryum (Schimp.) Limpr. Laubm. 2: 272. 1892.

Plants generally tufted, often densely so, rarely growing more separated or with other mosses; stems normally erect, simple or with basal shoots or innovations from various points of the stem, in section with central strand and a cortex of small, thick-walled, generally pigmented cells; leaves lanceolate or linear-lanceolate to ovate, mostly without distinct border, generally more or less denticulate toward apex; costa not very strong, generally ending at or below apex, in section with median guide-cells and mostly rather small cells ventrally; cells of leaf-blade in single layer, usually long and narrow, linear or rarely vermicular to more or less elongated rhomboidal-hexagonal, in basal part of leaf somewhat shorter, rectangular.

Inflorescence various, sometimes varying in the same species; seta long, slender or rather thick, flexuose and twisted on drying; capsule clavate to pyriform with longer or shorter neck, rarely erect or suberect, generally inclined to pendulous; cells of exothecium showing considerable variation, as do also the stomata in neck of capsule; operculum convex to conical, mamillate to short-rostrate; annulus mostly present, frequently removable; peristome inserted near mouth, double; teeth of exostome always well developed; endostome free of exostome, with low or high basal membrane, segments generally more or less split, cilia lacking or imperfect or fully developed according to species, but rarely appendiculate; spores round or nearly so, larger or smaller. Type species, *P. elongata* Hedw.

I have included in *Pohlia* several genera which are frequently separated: *Mniobryum*, *Epipterygium*, *Anomobryum* (the last having generally been associated with *Bryum*) and even a species of *Bryum*. None are separated by clear-cut characters from *Pohlia*, and, pending a thorough-going revision of the Bryaceae of the world, it seems better to operate with the larger genus. Even at that, it is not very distinct from *Bryum*.

KEY.

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|--|---------------------------|
| 1. Capsules erect, inner peristome more or less imperfect | 2. |
| Capsules slightly inclined to pendulous, inner peristome complete, except that cilia may be rudimentary or lacking | 3. |
| 2. Plants small, leaf-cells not pitted | 1. <i>defecta</i> . |
| Plants coarser, leaf-cells pitted | 2. <i>Cardoti</i> . |
| 3. Cilia of endostome, if present, not appendiculate (in <i>P. nutans</i> sometimes slightly appendiculate) | 4. |
| Cilia of endostome clearly appendiculate | 27. |
| 4. Leaves not clearly bordered | 5. |
| Leaves with lax areolation and border of narrow cells | 26. <i>Tozeri</i> . |
| 5. Capsules on drying clearly longer than wide | 6. |
| Capsules when mature, deoperculate and dry about as wide as, or wider than long | 21. (<i>Mniobryum</i>). |
| 6. Mostly without gemmae in leaf-axils, best recognized by other characters (<i>P. Drummondii</i> and especially <i>P. gracilis</i> may be found with gemmae) | 7. |
| Generally with greater or less number of gemmae in leaf-axils, by which character they are most easily recognized | 18. |
| 7. Leaves rather numerous and large, with distinct metallic lustre | 8. |
| Leaves without noteworthy lustre | 10. |
| 8. Operculum small, inner peristome consisting of narrow imperforate segments without cilia | 3. <i>crudoides</i> . |
| Operculum larger, inner peristome normal with segments and cilia | 9. |
| 9. Plants yellowish, capsule long-necked | 4. <i>longicolla</i> . |
| Plants whitish green, neck of capsule short and not well set off from capsule | 5. <i>cruda</i> . |

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|---|-----------------------------|
| 10. Cilia of endostome rudimentary or lacking..... | 11. |
| Cilia of endostome well developed..... | 12. |
| 11. Neck hardly as long as rest of capsule..... | 6. <i>acuminata</i> . |
| Neck as long as or longer than rest of capsule..... | 7. <i>elongata</i> . |
| 12. Inflorescence paricous (<i>P. Schimper</i> may also be found here)..... | 13. |
| Inflorescence dioicous..... | 14. |
| 13. Leaf-cells long and narrow, at least 7 or 8 times as long as wide..... | 8. <i>nutans</i> . |
| Leaf-cells thin-walled, generally only 3 or 4 times as long as wide..... | 11. <i>cucullata</i> . |
| 14. Robust plant of peat-bogs, resembling <i>P. nutans</i> except in inflorescence..... | 9. <i>sphagnicola</i> . |
| Distinct from <i>P. nutans</i> | 15. |
| 15. Robust plant of far north, with peculiar red pigmentation of some of leaf parts... | 10. <i>Schimperi</i> . |
| Leaf parts not red pigmented..... | 16. |
| 16. Leaf-margin reflexed..... | 17. |
| Leaf-margin not reflexed, stems and leaves stiffly erect (often with blackish gemmae)..... | 14. <i>gracilis</i> . |
| 17. Plants and leaves of normal size..... | 13. <i>Drummondii</i> . |
| Plants and leaves among largest of the genus, leaf-cells short..... | 12. <i>Ludwigii</i> . |
| 18. Gemmae large, with roundish red body, single in leaf-axils..... | 15. <i>Rothii</i> . |
| Gemmae smaller, not red, generally more than one to the leaf-axil..... | 19. |
| 19. Gemmae 1-3 per leaf-axil, obovate with short stalk, yellow bodied..... | 16. <i>bulbifera</i> . |
| Gemmae mostly more numerous and smaller..... | 20. |
| 20. Plants elongated, with broad leaves, yellowish green with lustre; gemmae elongated and numerous, only in axils of upper leaves, irregular, with one or at most two leaf-points..... | 17. <i>proliger</i> . |
| Leaves narrower, green, without lustre; gemmae varying from oval to elongated and twisted, with several leaf-points..... | 18. <i>annotina</i> . |
| 21. Stomata phaneropore..... | 22. |
| Stomata cryptopore..... | 23. |
| 22. Capsule with annulus, outer peristome teeth yellowish..... | 19. <i>pulchella</i> . |
| Capsule without annulus, outer peristome teeth brownish..... | 21. <i>atropurpurea</i> . |
| 23. Low growing plants, hardly exceeding 1 cm. in height..... | 24. |
| Plants normally above 1 cm. in height, sometimes much higher..... | 25. |
| 24. Leaf cells elongated, as much as 8 times as long as wide..... | 20. <i>vexans</i> . |
| Leaf cells lax and broad, not more than 5 times as long as wide..... | 23. <i>carnea</i> . |
| 25. Capsule urceolate..... | 25. <i>longibracteata</i> . |
| Capsule pyriform..... | 26. |
| 26. Smaller plant; annulus present, generally attached to operculum..... | 22. <i>columbica</i> . |
| Larger plant, whitish green; annulus lacking..... | 24. <i>Wahlenbergii</i> . |
| 27. Leaves closely imbricate on elongated and generally branched stem..... | 27. <i>filiformis</i> . |
| Leaves spreading; tropical species..... | 28. <i>Crügeri</i> . |

1. POHLIA DEFECTA (Sanio) n. comb.

Pohlia erecta Lindb. Rev. Bryol. 10: 7. 1883. Not *Trentepohlia erecta* Roth, Usteri, Ann. Bot. 10: 52 1794.

(*Webera erecta* Correns, Untersuchungen 160. 1899).

Mielichhoferia defecta Sanio, Bot. Centralbl. 13: 248. 1883.

Mielichhoferia erecta Kindb. Enumeratio 22. 1888.

Webera erecta Limpr. Laubm. 2: 239. 1891.

Plants erect, closely tufted, somewhat matted in lower discolored part by radicles, green in upper part; stem simple or somewhat branched, up to 15 mm. in length, the American plants often with a slender flagelliform innovation bearing small and distant leaves; stem reddish below; leaves erect, closely imbricate, decurrent, ovate-lanceolate, somewhat crenulate toward apex, without border, margin very slightly reflexed in lower part; costa often reddish, slender from somewhat broader base, regularly ceasing below apex; leaf cells thin-walled, elongated-rhomboidal to hexagonal, up to 70 x 20 μ , becoming more nearly

rectangular toward base. Inflorescence dioicous, both ♂ and ♀ plants in same tuft, which fruits more or less abundantly; both antheridia and archegonia terminal, enclosed in a gemmiform agglomeration of perigonal or perichaetial leaves; the ♂ buds are shorter and thicker than the ♀ ones, the perigonal leaves also shorter and broader than the perichaetial ones. Seta about 8 mm. long, slender, flexuose, reddish-brown when capsules are ripe; capsules erect, elongated-pyriform, contracting gradually to a rather short neck, deoperculate about 1.5 mm. long; wall rather thick, exothecial cells isodiametric, gradually becoming somewhat smaller toward mouth of capsule, but otherwise not altered nor pigmented; annulus present, removable; operculum brownish, low-convex, mamillate or very short-beaked; calyptra described as minute and fugacious; outer peristome teeth 16, yellowish, somewhat irregular in shape, papillose roughened; inner peristome fragile, sometimes apparently lacking or very rudimentary, consisting at most of a pale basal membrane with very rudimentary stumps of cilia and segments; spores 15–20 μ , yellow, slightly roughened.

Type locality, Norway.

ILLUSTRATIONS:—Engler & Prantl, Musci (Ed. 1) 1: f. 409, (Ed. 2) 10: f. 312; Bryologist 29: pl. 2; Pl. 73.

Growing on rock in snow-water, Paradise Valley, Rainier National Park, Washington at 7000 ft. altitude, fruits just ripe Aug. 5, 1925 when collected by the late Dr. J. W. Bailey. Through the kindness of Prof. Frye I have seen all of Bailey's material, and through the generosity of Dr. Johannes Lid in Oslo I have been able to compare abundant and good material of the original collection of Kaurin. The American material matches so closely the original collection named by Lindberg and by Sanio that I can only agree with Holzinger (Bryologist 29: 23. 1926) in identifying it with it. It is not known from Europe outside of Scandinavia, and it is not apparent that it has any very close relative in the genus.

The name *erecta* given by Lindberg was unfortunate in that the *Trentepohlia erecta* of Roth, published already in the 18th century, was a *Pohlia*, probably in fact more than one of them. It is of course possible to arbitrarily forget homonyms antedating 1801, though I must profess an inability to do so, but even then the late use of Roth's name (as *Webera erecta*) by Correns makes use of the name for another species a permanent source of confusion. Fortunately the very slightly later specific name of Sanio is available, based upon the same collection of Kaurin through a specimen obtained from Geheeb.

2. POHLIA CARDOTI (Ren.) Broth. Engler & Prantl, Musci (Ed. 1.) 547. 1903.

Webera Cardoti Ren. Rev. Bryol. 15: 71. 1888 (See also Bot. Gaz. 14: 95. 1889).

Bryum Cardoti Kindb. as subsp. of *Bryum commutatum*. Eur. and N. Am. Bryin. 338. 1897.

Pohlia porosa H. Lindb. Bull. Torrey Bot. Club 27: 318. pl. 21. 1900.

Webera porosa Par. Index Bryol. (Ed. 2) 5: 120. 1906.

Plants erect, closely or loosely tufted or growing with other mosses, somewhat matted by radicles in lower part, green or yellowish-green in upper part, brownish below; stems simple, rather strong, up to 2 cm. in height, round in section, with central strand; leaves erect, closely imbricate when dry, ovate-lanceolate, rather broad, about 1 x .5 mm., acute to subobtuse, slightly crenulate toward apex, margin reflexed; costa strong, reaching nearly to apex, much widened at base, in section biconvex, passing gradually into blade, showing 4 or more well marked median guide-cells with small thick-walled stereid cells ventrally and dorsally; cells of leaf-blade very short, especially in apical part of leaf, irregularly rounded-rhomboidal, up to 10 x 30 μ , with thick walls which are pitted with communicating pores, more rectangular at base, but otherwise not markedly different and still with rounded corners; base of leaf thick and clinging tenaciously to stem, showing here in section 2 or more layers of cells extending nearly to margin, not decurrent. Dioicous: ♂ stems mingled with ♀, so that capsules are often present; antheridia in a thick terminal bud, several in number, brown, about 0.4 mm. long, terminal, without paraphyses. Seta up to 15 mm. in length, reddish-brown, flexuose or even geniculate; capsule erect, symmetrical, elongated pyriform, about 2.5 mm. in length, neck nearly as long as rest of capsule, light greenish brown, becoming darker with age; operculum low convex-conical to higher conical, differing in browner color from capsule; annulus broad, removable; exothecial cells thick-walled, of irregular shape with wavy outline, gradually smaller toward mouth and more pigmented brown, but not flattened in distinct rows; stomata numerous, phaneropore, pore elliptical, rather large, 14 μ long; outer peristome teeth yellow, inserted near mouth of capsule, well developed, slightly margined in apical part, minutely papillose, with numerous lamellae; inner peristome imperfectly developed, hyaline, fragile; basal membrane low, and irregularly perforated, cilia rudimentary at most, segments narrow, rarely as long as outer teeth, irregularly perforated; spores round, brownish yellow, minutely roughened, 15 μ ; ripe in early September. Type locality, Mt. Hood, Oregon.

ILLUSTRATIONS:—Bot. Gaz. 14: pl. 13B; Bull. Torr. Bot. Club 27: pl. 21; Pl. 73.

EXSICCATI:—Allen, Mosses of Cascade Mts., Wash. 56.

The only localities at present known are the original one at Mt. Hood, Oregon (Henderson) and one on Mt. Rainier, Wash. (J. A. Allen). Both grew in wet ground "along rills" at 6000–8000 ft. altitude. Allen collected it both in 1898 and 1900 and said it was abundant, but rarely fruiting. The species is remarkably distinct with no apparent affinities. Renaud and Cardot had not noted the porose leaf-cells and their description and illustration is inferior to the later one of Harald Lindberg, but comparison of the types of both shows that the two species are quite identical.

3. *POHLIA CRUDOIDES* (Sull. & Lesq.) Broth. Engler & Prantl, Musci (Ed. 1.) 548. 1903.

Bryum crudoides Sull. & Lesq. Proc. Amer. Acad. 4: 278. 1859.

Pohlia crassidens Lindb. Rev. Bryol. 10: 5. 1883.

Webera trachydontea Sanio, Bot. Centralbl. 13: 247. 1883.

Webera crassidens Kindb. Enumeratio 22. 1888.

Webera crudoides Par. Index Bryol. 1349. 1897.

Plants erect, more or less densely tufted, not much matted with radicles, generally robust, up to 2 or even more cm. in height, yellowish with silky lustre; stems simple, strong, red; leaves small and distant on lower part of stem, increasing in size and more imbricate above, terminal ones tufted, stiffly erect, not much changed in drying, narrowly linear-lanceolate to lanceolate, acuminate, apex slightly twisted; margin strongly reflexed, distantly denticulate in apical part; costa strong, percurrent or nearly so; cells of leaf-blade narrowly linear-vermicular in upper part of leaf, up to $5 \times 70 \mu$, not much different in base. Dioicous: ♂ plants growing among ♀, which then commonly bear capsules; antheridia very numerous, axillary in a large terminal gemmiform capitulum, orange-colored. Seta strong, more or less lengthened (up to 4 cm.), light reddish-brown; capsule erect or slightly inclined, rather large, up to 4 or 5 mm. in length, cylindrical-ovate, generally slightly curved or at any rate asymmetrical, with a more convex dorsal side which may even be darker in color than the ventral side; not greatly altered in drying; neck short and broad so that it hardly appears differentiated from the rest of capsule; mouth of capsule and accordingly the operculum proportionately very small, the operculum short-conical, color of capsule light yellowish-brown when ripe, appearing darker in the Sullivant Herbarium type; annulus broad, removable; exothecial cells thin-walled, tending to be quadrangular, smaller toward mouth, but not in distinct rows; peristome delicate, very light yellow, outer of 16 linear, almost filiform teeth, very strongly papillose, sometimes adjacent teeth partially coalesced leaving irregular openings, lamellae not prominent; endostome also extremely papillose, with a low basal membrane and slender imperforate segments, generally shorter than outer teeth; cilia lacking; spores brownish, round, $15\text{--}18 \mu$, very slightly roughened. Type locality, "Behring's Strait."

ILLUSTRATIONS:—Mönkemeyer, Laubm. Eur. f. 99; Pl. 80.

An Arctic plant, known from a few localities in northern Scandinavia and Finland and from Greenland, probably extending through Arctic North America. Through the kindness of Norwegian botanists I have been enabled to see considerable good material from Norway, including the type of *P. crassidens*, collected by Kaurin. The type of *Bryum crudoides* I have had from the Sullivant Herbarium at Harvard University. It is obviously the same thing and long antedates Lindberg's species. The diagnosis as published by Sull. & Lesq. was a brief one, but the Sullivant Herbarium contains a fuller description together with one of the beautiful Sullivant drawings. All the characters brought out by Sullivant are those of *P. crassidens* and he recognized clearly, as his manuscript shows, that he had before him a quite distinct species. The specimen was collected by Charles Wright on the U. S. North Pacific Exploring Expedition under Commanders Ringgold and Rodgers 1853–56 and bears only the locality, "Behring's Strait," whether on the American or Asiatic side is not clear, but Lesquereux and James in their Manual of North American Mosses did not include it. I have seen from Greenland a small sterile specimen (leg. Hartz, 1892).

4. *POHLIA LONGICOLLA* (Sw.) Lindb. Musc. Scand. 18. 1879.

Bryum longicollum Sw. Disp. Musc. Suec. 49, 99. pl. 6, f. 13. 1799.

Webera longicolla Hedw. Sp. Musc. 169. pl. 41, f. 1–5. 1801.

Lamprophyllum longicolle Lindb. Revis. Crit. Icon. 26. 1871.

Plants erect, densely tufted, somewhat matted below with brown radicles, robust, up to 3 cm. in length, yellow-green with strong silky lustre; stem simple, slender, red; leaves closely arranged on stem, imbricate, erect, not much changed in drying, terminal ones tufted and longer than those below, narrowly lanceolate to linear-lanceolate, acuminate, apex twisted; margin plane or nearly so, sharply denticulate in upper part;

costa slender, yellow, generally ceasing just below apex; cells of leaf-blade narrowly linear, up to $7 \times 140 \mu$ or more. Inflorescence paroicous and plants accordingly regularly fruiting; antheridia in pairs in axils of comal leaves. Seta slender, flexuose, reddish brown when capsule is fully ripe; capsule up to 4 mm. long, inclined or horizontal, generally not completely symmetrical, but rather slightly bent, clavate, light brown in color, neck about as long as rest of capsule, sometimes shorter, strongly contracting on drying; operculum short convex-conical, sometimes slightly apiculate; annulus removable, brown on outer side; exothecial cells tending to be rectangular, thin-walled, 2 or 3 rows of much smaller isodiametric brown-pigmented cells at mouth of capsule; stomata phaneropore, pore slit-like, around 15μ long; peristome well developed; outer teeth slender, papillose, narrowly bordered, with fairly close and numerous lamellae; inner peristome pale, basal membrane fairly high, segments slightly, if at all, slit along median line; intervening cilia 2 or 3, inclined to be very short, slightly nodulose; spores round, brownish, papillose, about 20μ in diameter, maturing in August and September. Type locality, Europe.

ILLUSTRATIONS:—Swartz, l. c.; Hedwig, l. c.; Bry. Eur. *pl.* 346, upper part (as *Bryum elongatum* var. β); *Pl.* 74B.

EXSICCATI:—Drumm. Musc. Am. 270 (as *Bryum elongatum*); Sull. Musc. Allegh. 99 (as *Bryum elongatum*).

Distribution circumboreal, tending to high altitudes and latitudes, in America infrequent, extending southward in the west to Colorado, in the east sporadically from Greenland to North Carolina.

5. POHLIA CRUDA (L.) Lindb. Musc. Scand. 18. 1879.

Mnium crudum L. Spec. Plant. 1112. 1753.

Bryum crudum Huds. Fl. Angl. 491. 1778.

Webera cruda Bruch in Hüb. Muscol. Germ. 425. 1833.

Lamprophyllum crudum Lindb. Revis. Crit. Icon. 87. 1871.

Webera microapiculata C. M. & Kindb. Macoun, Cat. Can. Pl. 6: 115. 1892.

Plants erect or spreading, loosely tufted, not much matted with radicles, slender and soft, up to 2 cm. in height, or rarely more, light green verging to a whitish-green, very strongly lustrous with a metallic lustre; stem mostly simple, angular, red; leaves loosely erect-spreading, smaller and broader below, ovate-lanceolate; the comal ones closely arranged and generally bent outward from stem, abruptly narrower and longer, lanceolate, long-acuminate, distantly denticulate in apical part; costa slender, red in lower part, not reaching apex of leaf; cells of leaf-blade very long and narrow, about $7 \times 90 \mu$. Inflorescence variable, mostly dioicous or paroicous and producing some capsules; antheridia, if in separate inflorescence, axillary in terminal bud. Seta around 2 cm. in length, reddish, fairly strong, flexuose; capsule inclined or horizontal, about 5 mm. long, greenish-yellow to brown, thick-clavate to nearly cylindrical, neck short, broad and not sharply set off from rest of capsule, not more than half its length, generally less; operculum lighter in color, bluntly short-conical; annulus removable; exothecial cells irregular in shape, walls rather thick and darker in color, especially thickened in corners, gradually smaller and darker in 4 or 5 rows at mouth of capsule, last 1 or 2 rows flattened; stomata phaneropore, pore narrowly elliptical, 18μ long; peristome pale yellow; outer teeth broad, very narrowly margined, minutely papillose, with many close lamellae; inner peristome papillose, with rather low basal membrane, segments widely gaping at keel or quite split in two, cilia 2 or 3, nodulose; spores 18μ or more, brown, round, papillose, ripe May to July according to altitude and latitude. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. *pl.* 348; Braithw. Brit. Moss Fl. 2: *pl.* 67A; *Pl.* 74A.

EXSICCATI:—Drumm. Musc. Am. 269; Aust. Musc. Appal. 187; Sull. & Lesq. Musc. Bor. Am. 179b, (Ed. 2) 269; R. & C. Musc. Am. Sept. 302, 302b.

Growing on or about rocks or on soil, very widely distributed and rather common. In Europe, Asia and North America; in the latter continent reaching from the far north southward in the eastern states to Connecticut, New Jersey, and Pennsylvania, in the western states to Nebraska, Colorado, Arizona and California, from these connecting with occasional stations through Mexico and Central America to southern South America, the Antarctic, Australia and New Zealand.

6. POHLIA ACUMINATA Hoppe & Hornsch. Flora 2: 94. 1819.

Pohlia polymorpha Hoppe & Hornsch. Flora 2: 100. 1819.

Bryum acuminatum B. & S. Bry. Eur. fasc. 6-9: 21. *pl.* 342, 343 (upper part). 1839.

Bryum polymorphum B. & S. Bry. Eur. fasc. 6-9: 25. pl. 344. 1839.

Webera acuminata Schimp. Coroll. 64. 1855.

Webera polymorpha Schimp. Coroll. 65. 1855.

Plants erect, loosely tufted or gregarious and mingled with other mosses, with abundance of brown radicles below, slender, generally short, hardly reaching or exceeding 1 cm. in height, green, without lustre; stem simple or slightly branched, brown; lower part of stem nearly bare, with a few distant scale-like leaves; comal leaves densely tufted, erect and closely imbricate, lanceolate, acuminate; margin reflexed, apex slightly denticulate; costa slender, percurrent or nearly so; cells of leaf-blade thick-walled, narrow, linear, up to $7 \times 70 \mu$, somewhat shorter and broader at base. Inflorescence paroicous (antheridia in 2's in axils of comal leaves) or autoicous (antheridia in the gemmiform termination of a special branch); plants generally fruiting. Seta slender, up to 2 cm. long, somewhat curved, red below, paler above; capsule inclined or nearly erect or sometimes horizontal or nearly pendulous, narrowly clavate to subcylindrical, slightly curved and asymmetric, light brown, neck narrow, shorter than or of nearly equal length with rest of capsule; operculum sharply conical to slightly rostrate, small, of same color as rest of capsule, but set off from it by red line of annulus, which is removable; peristome yellow; outer teeth slender, papillose, with numerous close lamellae; inner peristome with low basal membrane, segments narrow, filiform, about as long as outer teeth, very slightly slit; cilia lacking; exothecial cells of capsule thick-walled, elongated, but gradually shortened toward mouth of capsule, where 3 or 4 rows are smaller and slightly darker-pigmented, but not flattened; stomata phaneropore; spores yellow, $10-20 \mu$, ripening in late summer or early fall. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 342, 343 (upper part), 344; Pl. 75B.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 264.

Crevices of rocks in mountains, uncommon in North America. It is a plant of circumboreal distribution, extending south in the eastern states to the Adirondack Mts. of New York, in the western states to Arizona. It has been so often pointed out that there is no essential difference between *P. acuminata* and *P. polymorpha* that it is high time to treat them as a single species. The two types of inflorescence may easily be demonstrated on the same plants. As both names were published simultaneously and *acuminata* has priority of place (pagination), it is reasonable to treat *P. polymorpha* as its synonym. The name *polymorpha* would be appropriate as the species shows considerable variation in most of its characters.

7. POHLIA ELONGATA Hedw. Descr. 1: 96. pl. 36. 1787.

Webera elongata Schwaegr. in L. Sp. Pl. (Ed. 4) 5^o: 48. 1830.

Plants erect, loosely tufted or gregarious, with brown radicles below, slender, short, 1 or at most 2 cm. in height, green, without lustre; stem simple, red or purplish brown; leaves mostly on upper part of stem, gradually increasing in size to the comal ones, erect-spreading, irregularly bent on drying, lanceolate, long-acuminate; margin reflexed, upper part sharply denticulate; costa fairly strong, percurrent or slightly excurrent; cells of leaf-blade thin-walled, elongated rhomboidal above, up to $15 \times 70 \mu$, long-rectangular in basal part. Inflorescence paroicous: antheridia in pairs in axils of comal leaves, the plants regularly fruiting. Seta comparatively long, up to 3 cm., slender, reddish below, lighter above; capsule inclined or sometimes nearly horizontal, very long and slender, up to 4 or 5 mm. long, cylindrical or narrowly clavate, frequently somewhat curved and asymmetrical, yellowish brown, becoming darker with age; neck narrow, of equal or greater length than rest of capsule; operculum conical, sharply apiculate; exothecial cells somewhat elongated-rectangular, thick-walled, gradually smaller in 4 or 5 rows of isodiametric cells at mouth, which are slightly darker-pigmented; stomata phaneropore; annulus removable; peristome inserted near mouth of capsule; outer teeth yellow, fairly broad, papillose, narrowly bordered, with numerous close lamellae; inner peristome hyaline, papillose, with rather low basal membrane, segments of irregularly serrate outline, narrowly perforated or not; cilia lacking or 2 or 3, short or longer, nodulose, sometimes coalescing above; spores brownish, $15-20 \mu$, papillose, ripening rather late (Aug. or Sept.). Type locality, Germany.

ILLUSTRATIONS:—Hedw. Descr. 1: pl. 36; Bry. Eur. pl. 345; Limpr. Laubm. 2: f. 271; Pl. 75C.

EXSICCATI:—Aust. Musc. Appal. Suppl. 510; Sull. Musc. Allegh. 99; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 177, (Ed. 2) 266.

On ground in woods, especially in mountainous localities, not common. Of circumboreal distribution, not reaching the highest latitudes, extending southward in the mountains to North Carolina and Tennessee, westward through Wisconsin and Minnesota to British Columbia.

8. *POHLIA NUTANS* (Schreb.) Lindb. Musc. Scand. 18. 1879.*Bryum nutans* Schreb. Spic. 81. 1771.*Webera nutans* Hedw. Descr. 1: 9. pl. 4. 1787.

Plants erect, generally loosely tufted, with brown radicles below, slender, of varying length, mostly not more than 1 or 2 cm., green or yellowish-green, without marked lustre; stem usually simple, red; leaves generally scattered and small on lower part of stem, crowded and longer above, ovate-lanceolate to linear-lanceolate, acuminate, erect, imbricate, not greatly changed in drying; margin slightly reflexed at least in lower part, slightly denticulate toward apex; costa rather strong, sometimes reddish, reaching apex or nearly so; cells of leaf-blade thick-walled, long and narrow, linear to elongate-hexagonal, up to $10 \times 70 \mu$. Inflorescence parocious: antheridia in pairs in axils of comal leaves, plants regularly fruiting. Seta slender, generally long, up to 4 cm. and often much curved, reddish brown; capsule horizontal to pendulous, pyriform, symmetrical or slightly curved, light brown, neck not strongly differentiated nor always greatly contracted in drying, normally shorter than rest of capsule; operculum broad, convex, apiculate; annulus prominent, removable; exothelial cells thin-walled, irregularly lengthened except 3 or 4 rows at mouth which are small and darker-pigmented, last 1 or 2 rows flattened; stomata phaneropore, pore slit-like; peristome inserted close to mouth of capsule; outer teeth well developed, yellow, papillose, with numerous and prominent lamellae; inner peristome light yellow, with high basal membrane, segments nicely developed, with wide gap and serrate outline; intervening cilia 2 or 3, nodulose or rarely slightly appendiculate; spores about 20μ , ripening in summer. Type locality, Germany.

ILLUSTRATIONS:—Hedw. Descr. 1: pl. 4; Bry. Eur. pl. 347; Pl. 75A.

EXSICCATI:—Drumm. Musc. Am. 262; Aust. Musc. Appal. 185, 186; Sull. & Lesq. Musc. Bor. Am. 178 (in part), 179, (Ed. 2) 267, 268; Holz. Musc. Acro. Bor. Am. 166, 167, 524; R. & C. Musc. Am. Sept. 221, 221b; Grout, Musci Perf. 23.

Growing on various substrata: ground, rocks, bogs, decaying wood. A common, variable and nearly cosmopolitan species, in tropical and subtropical regions confined to mountain altitudes, in North America extending from Greenland and Alaska south at least to N. Carolina, Colorado, Arizona and California.

9. *POHLIA SPHAGNICOLA* (B. & S.) Lindb. & Arn. Musc. Asiae Bor. 2: 53. 1890.*Bryum sphagnicola* B. & S. Bry. Eur. fasc. 32: 6. pl. 349. 1846.*Webera sphagnicola* Schimp. Coroll. 66. 1855.

Plants loosely tufted or variously intertwined with *Sphagnum*, resembling *P. nutans*, with brown radicles from various parts of stem, slender, generally much elongated, up to 4 cm. or more, yellowish green, without noteworthy lustre; stem simple or occasionally branching, especially by subfloral innovations, dark blackish-red except in extreme upper part; leaves distant and small on lower part of stem and throughout flagelliform branches, the comal leaves erect, closely imbricate, linear-lanceolate, with margin plane or nearly so, slightly denticulate toward apex; costa slender, mostly not quite percurrent; cells of leaf-blade nearly linear, thick-walled, up to about $7 \times 70 \mu$. Inflorescence dioicous: ♂ plants sometimes intermingled with ♀, plants then fruiting abundantly; antheridia in pairs in axils of perigonal leaves in a terminal disk-shaped inflorescence. Seta slender and irregularly curved, up to 4 cm. or more in length, yellowish-brown; capsule about 3 mm. long, pendulous, pyriform with a short neck which contracts in drying, light brown in color, not greatly contracting below the broad mouth in drying; operculum large, of same color as capsule, slightly convex with generally blunt apex; annulus removable, but clinging somewhat to lid; exothelial cells with thickened and somewhat wavy walls, irregular in shape, gradually shortened in about 5 rows at mouth of capsule, last 2 rows flattened; stomata phaneropore, pore small, slit-like; peristome attached somewhat below mouth of capsule; outer teeth yellow, slender, papillose, distinctly bordered and with close and prominent lamellae; inner peristome hyaline, with high basal membrane, segments broadly fenestrate at keel, serrate in outline, intervening cilia 2 or 3, nodulose; spores very small, about 10μ , pale yellow, smooth or nearly so, maturing in summer. Type locality, Norway.

ILLUSTRATIONS:—Bry. Eur. pl. 349; Pl. 76A.

Apparently a species of circumboreal distribution, known only from scattered stations, perhaps because it is not easily distinguished from *P. nutans*. Reported by Lesquereux from the Adirondacks of N. Y. The specimen from Kingston, Nova Scotia, collected by Macoun and identified by Kindberg as this species (Canadian Cryptogams 48) may be right; at any rate I found only archegonia on it and no antheridia.

Mr. Williams's specimen from the Yukon was, as he said, paroicous, which excludes it from this species. Other American specimens that I have seen named *sphagnicola* were wrongly identified.

10. POHLIA SCHIMPERI (C. M.) n. comb.

Bryum rutilans Schimp. Bry. Eur. fasc. 32, Suppl. 5. *pl.* 350. 1846. Not *B. rutilans* Brid. Bry. Univ. 1: 684. 1826.

Bryum Schimper C. M. Syn. 1: 334. 1848.

Webera rutilans Schimp. Coroll. 66. 1855.

Webera Schimper Schimp. Syn. 338. 1860.

Pohlia rutilans Lindb. Musc. Scand. 18. 1879.

Plants erect, densely tufted, closely matted with brown radicles below, slender, living parts of plants up to 2 cm. in height, the dead stems in specimen described can be followed to 5 cm. in length, ground color yellowish green, but with many of the plants pigmented bright red, without noteworthy lustre; stems generally simple, slender, red; leaves rather distant except in comal part, all closely appressed to stem, long-lanceolate, tending to be slightly decurrent; margin somewhat reflexed, apical part of comal leaves slightly denticulate; costa fairly strong, often red, mostly percurrent; cells of leaf-blade thick-walled, linear or slightly vermicular, up to $10 \times 70 \mu$. Inflorescence variable, in part paroicous, in part with separate gemmiform antheridial heads, at first regarded as dioicous. Seta slender, curving, up to 1.5 cm. in length, yellowish brown; capsule about 3 mm. long, mostly pendulous, broad-pyriform with a short neck, light yellowish brown in color; operculum set off from capsule by a distinct red line, otherwise of color of capsule, rather large, slightly convex with blunt apex; annulus brown on outside, clinging for a time to operculum; exothelial cells somewhat irregular in shape, with thick walls, gradually shortened and darker-pigmented in 4 or 5 rows at mouth of capsule; stomata phaneropore, pore slit-like; outer peristome teeth pale yellow, rather narrow, slightly papillose and very narrowly bordered, lamellae fairly prominent, close below; inner peristome delicate, hyaline, almost smooth; basal membrane not very high, segments slender, fenestrate with narrow slits, slightly serrate in outline above; cilia nodulose; spores about 20μ , round, brown, papillose.

ILLUSTRATIONS:—Bry. Eur. *pl.* 350; *Pl.* 76B.

A plant of the extreme north, known outside of Norway and Spitzbergen only from Greenland, Arctic America and Vancouver Id.

11. POHLIA CUCULLATA (Schwaegr.) Bruch, Flora 9¹: 274. 1826.

Bryum cucullatum Schwaegr. Suppl. 1²: 94. *pl.* 68. 1816.

Webera cucullata Schimp. Coroll. 66. 1855.

Plants densely tufted, closely matted with brown radicles below, living plants up to 1.5 cm. in height (the dead stem can sometimes be followed to a distance of 5 cm.), light yellowish-green, without lustre, but with a somewhat translucent effect; stems normally erect, simple or slightly branching, red or reddish; leaves closely imbricate, of good size, sometimes somewhat contorted or even subsecund on drying, mostly comparatively broad, ovate or the comal ones ovate-lanceolate, the lower ones generally obtuse and concave, giving a cucullate effect, the comal ones also sometimes obtuse, sometimes more acute; margin plane or nearly so, very slightly denticulate in apical region; costa strong at base, ending at a greater or less distance below the apex; cells of leaf-blade thin-walled and short, rhomboidal to hexagonal-rhomboidal, up to $18 \times 70 \mu$ in upper part of leaf, more nearly rectangular toward base. Inflorescence paroicous with antheridia in pairs in axils of comal leaves, plants then regularly fruiting. Seta fairly strong, curving, up to 1.5 cm. in length, yellowish-brown; capsule pendulous, pyriform, with comparatively short neck, brown, not constricted below mouth in drying; operculum rather small, convex; annulus removable; peristome rather small, inserted somewhat below mouth of capsule; outer teeth yellow, slender, very papillose, with rather few somewhat distant lamellae; inner peristome delicate, hyaline, with low basal membrane and narrow filiform segments, slightly slit along keel; intervening cilia short and fugacious; exothelial cells thin-walled, irregular in shape and size, not elongated, abruptly much smaller in some 5 rows at mouth of capsule, the latter cells mostly flattened and darker pigmented; stomata phaneropore, pore slit-like; spores 20μ or more, round, brownish, finely roughened. Type locality, Norway.

ILLUSTRATIONS:—Schwaegr. Suppl. 1²: *pl.* 68; Bry. Eur. *pl.* 343 (lower part), *Pl.* 77B.

A plant of alpine and high northern distribution, in our range seen from Greenland and Labrador. Other American specimens called *P. cucullata* were wrongly determined and I have only a single specimen

collected with unripe fruit on Aug. 2, 1922 by Carlotta C. Hall (No. 65) from Mt. Dana, California (alt. 9950 ft.) which is this species. The species was reported from Mt. Dana in the L. & J. Manual (p. 218), collected by Bolander, but I have not seen his specimen. Of the 2 Sull. & Lesq. Exsiccati numbers labeled *Bryum cucullatum*, both apparently from the White Mts. of New Hampshire, 176 (Ed. 1) is characteristic *P. nutans*, 265 (Ed. 2) is good *P. Drummondii* (*P. commutata*) with dioicous inflorescence and characteristic leaves and propagula. A locality from St. Paul Island in Behring Sea is mentioned later.

12. *POHLIA LUDWIGII* (Spreng.) Broth. Act. Soc. Sc. Fenn. 19: No. 12, p. 27. 1892.

Bryum Ludwigii Spreng. Schwaegr. Suppl. 1^o: 95. pl. 68 (right). 1816.

Webera Ludwigii Schimp. Syn. (Ed. 2). 402. 1876.

Bryum Bigelovii Sull. Pac. R. R. Rep. 10: 187. pl. 5. 1857.

Webera Bigelovii Lesq. & James, Manual 223. 1884.

Plants closely tufted, with little development of radicles, living plants up to 3 cm. in height (the dead parts may be followed to double this distance or even further), yellowish-green running into reddish-brown in older portions, without lustre; stems strong, erect, simple or with subfloral innovations, red; leaves numerous, erect, somewhat contorted in drying, broadly ovate, narrowly reflexed at margin, the lower and smaller ones not reflexed, entire or very slightly toothed at apex, strongly decurrent; costa rather strong, especially at base, ceasing below apex; cells of leaf-blade thin-walled, irregularly rhomboidal-hexagonal, relatively broad, up to $20 \times 70 \mu$ in what are regarded as normal leaves, but on same plants may be found narrower leaves with narrower leaf cells ($10 \times 70 \mu$); marginal cells very narrow and long, but not appearing as a distinct border; cells toward base of leaf shorter and rectangular. Inflorescence dioicous: ♂ plants sometimes interspersed with others, which may then fruit; antheridia in axils of perigonal leaves in large terminal buds, the perigonal leaves long-acuminate with spreading tips; paraphyses yellow, filiform. Capsule of good size, 3 mm. long, pendulous, ovate with short neck which contracts in drying, generally curved and asymmetrical, contracted below mouth in drying, greenish-brown; operculum convex, short-apiculate; annulus prominent and removable, brown on outside; exothecial cells thin-walled, tending to be hexagonal, gradually smaller in some 5 rows at mouth of capsule, last rows pigmented darker brown; stomata phaneropore; peristome inserted close to mouth of capsule, yellow; outer peristome teeth rather narrow, finely papillose, very narrowly bordered, with rather close and numerous lamellae; inner peristome with rather high basal membrane, papillose, with segments rather narrow but gaping; intervening cilia 2 or 3, entire or slightly nodulose; spores around 15μ , brownish, minutely roughened, ripening in late summer. Type locality, Europe.

ILLUSTRATIONS:—Schwaegr. Suppl. 1^o: pl. 68; Pac. R. R. Rep. 10: pl. 5. (The plate in Bry. Eur. pl. 351 named *Bryum Ludwigii* is *P. Drummondii*); Pl. 77A.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 346.

Besides in Europe this species occurs in Greenland and Labrador and in western North America from the Canadian Rockies southward to Colorado and California. When Sullivant described *Bryum Bigelovii* as a new species he was obviously under the impression (as were also the authors of the Bry. Eur. and most bryologists of the time) that the name *B. Ludwigii* belonged to the species subsequently distinguished by Schimper (1876) as *Webera commutata*. As a matter of fact *P. Ludwigii* does give the impression of a considerably enlarged *P. commutata* (*P. Drummondii*) and apparently finds its closest relationship with that species.

13. *POHLIA DRUMMONDII* (C. Muell.) n. comb.

Bryum nutans var. *minor* Drumm. Musc. Bor. Am. 263. 1828.

Bryum Drummondii C. Muell. Bot. Zeit. 20: 328. 1862.

Bryum nudicaule Lesq. Mem. Calif. Acad. Sc. 1: 21. 1869.

Webera commutata Schimp. Syn. (Ed. 2) 403. 1876.

Pohlia commutata Lindb. Musc. Scand. 17. 1879.

Webera Drummondii Lesq. & James, Manual, 219. 1884.

Webera nudicaulis Lesq. & James, Manual, 220. 1884.

Webera polymorphoides Kindb. Mac. Cat. Can. Pl. 6: 111. 1892.

Webera subcucullata C. Muell. & Kindb., Mac. Cat. Can. Pl. 6: 113. 1892.

Webera pycnocyrensis C. Muell. & Kindb. Mac. Cat. Can. Pl. 6: 114. 1892.

Bryum alpinum denticulatum Card. & Thér. Bot. Gaz. 30: 123. 1900.

Plants generally closely tufted, with little development of radicles, living parts of plants around 1 cm. in height, sometimes considerably more elongated, yellowish-green, running into brown in older portions, without noteworthy lustre; stems rather slender, generally more or less erect, mostly simple, innovating from apex or subflorally, red to nearly black; leaves numerous, erect, loosely imbricate when dry, frequently appearing catenulate, tending to be slightly decurrent, ovate to ovate-lanceolate, short-acuminate to acute or nearly obtuse; margin generally narrowly reflexed, slightly toothed toward apex; costa ending below apex, sometimes reddish; cells of leaf-blade thin-walled, rhomboidal-hexagonal, up to $15 \times 70 \mu$ or often broader and shorter; gemmae occasional, usually single in axils of leaves, reddish with prominent leaf-points. Inflorescence dioicous: ♂ plants often interspersed with others and abundant capsules then produced; antheridia in terminal buds on shorter or longer stems, frequently with subfloral innovations, axillary, with filiform hyaline paraphyses. Seta often short, 1 cm. in length or somewhat longer, flexuose, light reddish-brown; capsule pendulous, rather small, not more than 3 mm. long, generally less, very thick-walled, mostly light yellowish-brown, sometimes darker with age, pyriform, generally somewhat bent and asymmetrical, especially in neck, which is of equal length or shorter than rest of capsule; operculum short-conical; annulus narrow, removable or somewhat clinging to operculum, orange on outside; exothecial cells irregular in size and shape, not lengthened, their walls irregularly thickened and curved or wavy, gradually reduced in size in some 7 or 8 rows at mouth of capsule; stomata phaneropore, pore small, narrowly elliptical, about 10μ long; peristome light yellow, inserted close to mouth of capsule; outer teeth broad at base and set closely together, very minutely papillose and narrowly bordered, lamellae numerous and close in lower part; inner peristome with fairly high basal membrane, delicate, papillose, segments slit at keel, cilia 2 or 3, not nodulose, sometimes reduced or lacking; spores $15-20 \mu$, brown, roughened. Type locality, the Canadian Rockies.

ILLUSTRATIONS:—Bry. Eur. pl. 351 (as *Bryum Ludwigii*; except var. β); Sull. Icones, Suppl. pl. 34 (as *B. nudicaule*); Correns, Unters. f. 104, 105; Pl. 65.

EXSICCATI:—Drumm. Musc. Am. 263 (as *Bryum nutans* var. *minor*); Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 265 (as *B. cucullatum*), 270 (as *B. Ludwigii*); Holz. Musc. Acro. Bor. Am. 143.

A species of Europe and mostly western North America, where it is rather common southward to Colorado, Arizona and California, and takes on a variety of forms according to habitat, which has led to an extensive synonymy. It occurs in Greenland, and the Sull. & Lesq. exsic. No. 265 (Ed. 2) already mentioned under *P. cucullata*, appears to bring it down to the White Mts. of N. H., unless there is something wrong about the location given on the label or our interpretation of it; I have seen no other specimen of it from the eastern U. S., Holzinger's No. 143b, collected by Grout on Mt. Mansfield, Vt., and distributed by Holzinger as *Pohlia* or *Webera commutata* having papillae at the ends of its leaf-cells and being, I assume, a *Philonotis*. The propagula are not common in American specimens, but are occasionally present. They differ from those of the other gemmiferous species in being more enclosed within the leaves so that one is not likely to see them until he has the plant under the microscope. They show a reddish body with more completely formed leaves attached not so near the apex, but farther down the body, so that, as Correns emphasizes, they reveal more clearly their identity as rudimentary branches.

As to the name, Drummond's No. 263, which furnished the type for C. Müller's species, had in the N. Y. Bot. Garden already been placed in the *Webera commutata* cover and the combination *Webera Drummondii* already made by Mrs. Britton, in herb.

14. POHLIA GRACILIS (Schleich.) Lindb. Musc. Scand. 17. 1879.

Bryum Ludwigii var. β *gracile* Schleich. B. & S. Bry. Eur. fasc. 6-9: 39. pl. 351 (var. β). 1839.

Webera gracilis De Not. Epil. 418. 1869.

Webera commutata β *gracilis* Schimp. Syn. (Ed. 2) 404. 1876.

By some regarded as a variety of the preceding species. It is distinguished by elongated erect-growing stems with narrower leaves, closely appressed to the stems, their margins not reflexed, somewhat more frequent gemmae and, when fruiting, shorter-necked capsules. Propagula are borne singly in the leaf-axils, are rather large and prominent, with a bulbous oval body, tending to be blackish when ripe and with a few short leaf-points in apical part.

ILLUSTRATIONS:—Bry. Eur. pl. 351 (var. β); Pl. 79C.

EXSICCATI:—Mac. Can. Musc. 424.

A few specimens have been seen with a range extending from the Yukon to Montana and Washington. Were it not for the decided difference in the propagula, I should be inclined to regard this species as a fairly well marked variety of *P. Drummondii*. Loeske, who had paid special attention to this group of *Pohlia*, asserted that he had never seen intergrading forms between *P. commutata* and *P. gracilis*. However, on the

somewhat vague borderline between them, several doubtful species have been proposed, one of which, *P. carinata* (Brid.) Möll., was reported from North America by Card. & Thér. (Bot. Gaz. 30: 20. 1900). Loeske denied the existence of a species *P. carinata* and referred it to different species, including *P. commutata* and *P. gracilis*. I see no good reason to disagree with his judgment in the matter.

15. *POHLIA ROTHII* (Correns) Broth., Engler & Prantl, Musci (Ed. 1) 551. 1903.

Webera Rothii Correns, Limpr. Laubm. 3: 728. 1902.

Webera erecta (Roth) Correns, Untersuchungen 159. 1899. Not *Webera erecta* (Lindb.) Limpr. Laubm. 2: 239. 1891.

Plants gregarious or loosely or sometimes closely tufted, with some development of brown radicles in lower part, short or up to 2 cm. or more in height, yellow-green with decided lustre; stems slender, erect, generally simple, innovating apically or subflorally, red; leaves numerous, erect-spreading, somewhat distant and not imbricate when dry, somewhat decurrent, ovate-lanceolate, acuminate; margin narrowly reflexed, slightly toothed toward apex; costa percurrent or nearly so, not red; cells of leaf-blade thin-walled, narrowly linear-rhomboidal in upper part of leaf, up to $7 \times 70 \mu$, a little broader in basal part; gemmae prominent, single in axils of some of leaves on sterile shoots, round or elongated, generally bright red, tipped with small acute leaf-tips. Inflorescence dioicous: ♂ plants sometimes interspersed with others and few or more numerous capsules produced, but tufts are frequently found without capsules; antheridia in terminal (sometimes innovating) bud-like heads. Seta slender, up to 2 cm. in length, flexuose, light red or reddish-brown; capsule pendulous to horizontal, up to 4 mm. in length, pyriform, with neck (strongly contracted in drying) hardly as long as rest of capsule, yellowish-brown or darker-pigmented; operculum short-conical; annulus removable; exothecial cells thin-walled, varying in size and shape, not much elongated, with curving outline, smaller in about 4 rows at mouth of capsule, only last 1 or 2 rows slightly flattened and very slightly darker-pigmented; stomata numerous, phaneropore, pore small, slit-like; outer peristome teeth well developed, broad in basal part, yellow, finely and closely papillose, narrowly bordered in apical part, with numerous close and prominent lamellae; inner peristome lighter in color, with finely papillose high basal membrane, broad segments gaping at keel, cilia 2 or 3, nodulose; spores round, about 18μ , brownish-yellow, slightly roughened, ripening in summer. Type locality, Europe.

ILLUSTRATIONS:—Correns, Untersuchungen f. 95-98; Pl. 78.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. 180, (Ed. 2) 271 (both as *Bryum annotinum*).

Evidently a plant of circumboreal distribution, growing on moist sand. In America little attention has been paid to it. In our eastern states it is not uncommon in the White Mts. of New Hampshire, from which there is a specimen in the Austin Herbarium, collected 1872, labeled *Bryum annotinum*, and the two Sull. & Lesq. numbers cited above probably came from the same region. I have collected it both in the White Mts. and on Mt. Greylock, Mass., and it is possible that Austin had it from still farther south, from the Catskills of N. Y. or even from New Jersey, but his specimens are scant, old and not easily determinable. The N. Y. Botanical Garden Herbarium has a specimen of it from Alaska (Harriman Expedition, 1899) labeled *Webera annotina*.

Though the *Trentepohlia erecta* of Roth clearly included this species, it also contained other species and after considerable research in the bryological literature antedating Hedwig with reference to the gemmiferous Pohliales I have found no better solution of the nomenclatorial difficulties than the adoption of the name finally suggested by Correns for this species.

16. *POHLIA BULBIFERA* (Warnst.) Warnst. Laubm. 429. 1904.

Webera bulbifera Warnst. Bot. Centralbl. 66: 230. 1896.

Bryum pseudocarneum Kindb. Ottawa Naturalist 14: 88. 1900.

Plants gregarious or more or less closely tufted, with some development of radicles below, up to 1.5 cm. in height or sometimes more, yellow-green with lustre; stems slender, erect or somewhat flexuose, simple, red or reddish, at least in lower part; leaves numerous, rather distant, somewhat spreading both dry and moist, decurrent, lanceolate, acute to slightly acuminate; margin plane or nearly so, strongly toothed; costa fairly strong, percurrent or nearly so, not red; cells of leaf-blade thin-walled, narrowly rhomboidal-vermicular in upper part, up to $10 \times 70 \mu$, in some specimens broader and shorter; gemmae numerous, along nearly whole length of stem, 1-3 per leaf-axil, yellow when mature, rather solid, obovate, short-stalked, with blunt leaf-like lobes sheathing apex. Inflorescence dioicous: ♂ plants not numerous among others, capsules apparently not common; antheridia in terminal heads, with some long-acuminate leaves. Seta

slender, geniculate, 2 cm. or more in length, light reddish-brown; the single available (deoperculate) capsule was horizontal, about 4 mm. long, rather elongate-clavate, brown, gradually narrowing to the rather long neck; exothecial cells irregular, with 4 reduced rows at mouth of capsule, the last 2 flattened and darker-pigmented; the outer peristome teeth were brownish with darker brown margin, papillose, with numerous close and prominent lamellae; inner peristome yellowish, papillose, with high basal membrane, fairly narrow segments, serrate in outline, gaping at keel, cilia strongly nodulose. Type locality, Europe.

ILLUSTRATIONS:—Correns, Untersuchungen f. 103; Pl. 78.

EXSICCATI:—Reliquiae Farlowianae, Musci 573 (as *Webera annotina*).

Not much is known about the distribution of this species outside of Europe. The name and description of Kindberg's *Bryum* (*Webera*) *pseudocarneum* does not strongly suggest this species, but the 2 packets in his herbarium are clearly referable to it. They were collected by Macoun on Sable Island, Nova Scotia, July 21 and 28, 1899. Farlow's specimen is from Magnolia, Mass., July 5, 1903. I have collected it once in the White Mts. of New Hampshire in wet sand along an old road from Randolph to the Glen House, July 22, 1918.

17. *POHLIA PROLIGERA* Lindb. in litt. Broth., Engler & Prantl, Musci (Ed. 1) 551. f. 412 E-K.
1903 (name and figure).

Webera proligera Kindb. Enum. Bryin. Dovrens. Append. No. 309. 1888 (name only?); Limpr. Laubm. 2: 265. 1892 (description).

Plants gregarious or loosely tufted, without much development of radicles, up to 2 cm. in height, yellow-green with decided lustre; stem slender, erect, simple, red; leaves numerous on sterile shoots, rather closely placed, erect-spreading when moist, more nearly imbricate and slightly plicate longitudinally when dry, broadly ovate-lanceolate, acute to short acuminate, decurrent, slightly reflexed at margin, slightly denticulate toward apex; costa percurrent, not red, unless at base of leaf; cells of leaf-blade thin-walled, narrow, up to $10 \times 100 \mu$ in upper part of leaf; gemmae small and very numerous in upper part of stem, more than 5 per leaf-axil, yellowish, slender and of various shapes, vermicular and variously bent and distorted, often with a single point, more rarely with 2 or 3.

Dioicous and generally sterile, fruiting more frequently in the northern part of its range; antheridia in terminal buds. Seta slender, reddish, 2 cm.; capsule horizontal to pendulous, rather short, about 2.5 mm., with short neck, brown, thick-walled; exothecial cells irregular, not lengthened, with thick walls and wavy outlines, gradually reduced in size and more regular toward mouth of capsule, the last 4 or 5 rows somewhat flattened and darker pigmented; stomata phaneropore, pore slit-like; outer peristome teeth yellow, finely papillose, hardly bordered, with numerous close and clearly defined but not prominent lamellae; inner peristome delicate, very finely papillose, with high basal membrane, narrowly perforated segments and slightly nodulose cilia. Type locality, Norway.

ILLUSTRATIONS:—Correns, Untersuchungen. f. 101, 102; Engler & Prantl, l. c. and (Ed. 2) f. 313 E-K; Pl. 78.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 114, 663; R. & C. Musc. Am. Sept. 379; Bauer, Musc. Eur. et Am. Exsic. 1736.

This species has been frequently confused (also by myself) with *P. annotina*, especially with the form of the latter distinguished by Loeske as var. *decipiens*. The real *P. proligera*, of which I have now seen type material from the Kindberg Herbarium, is a plant of more northern distribution, extending from Greenland to the Yukon and southward to a line represented by Quebec, northern Michigan, Wisconsin, Minnesota, Colorado, British Columbia. All material from our eastern states called *P. proligera* belongs to the following species.

18. *POHLIA ANNOTINA* (Hedw.) Loeske, Verh. Bot. Ver. Prov. Brandenburg 46: 181. 1905.
Not Lindb. Musc. Scand. 17. 1879.

Bryum annotinum Hedw. Spec. Musc. 183. pl. 43. 1801. Not *Mnium annotinum* L. Sp. Pl. 1111. 1753.
Webera annotina Bruch. Hüben. Muscol. Germ. 431. 1833.

Webera campitotrachela R. & C. Bot. Gaz. 13: 199. pl. 16. 1888.

Plants gregarious or very loosely tufted, without much development of radicles, sterile shoots up to 2 cm. in height, yellowish-green to darker green, without lustre; stems very slender, erect-flexuose, simple, reddish below, passing to yellowish-green above; leaves on sterile shoots distant, erect-spreading both moist and dry, otherwise lacking stiffness when dry, decurrent, narrowly lanceolate, not reflexed at margin,

somewhat toothed at apex; costa strong, yellowish, percurrent; cells of leaf-blade somewhat thick-walled, nearly linear, up to $7 \times 80 \mu$; gemmae in axils especially of upper leaves, generally 2-5 per leaf, yellow to green, varying from small ovate to cuneiform and (in var. *decipiens* Loeske) elongated twisted-vermiform, generally with 3-4 acute erect leaf-points. Inflorescence dioicous; plants commonly sterile, but sometimes fruiting abundantly; in latter case male plants mingled with others; antheridia in relatively large terminal buds. Seta slender, flexuose, light red, up to 2 cm. or more in height; capsule horizontal to pendulous, long-pyriform, about 3 mm. in length, with neck about as long as rest of capsule and contracted in drying, often somewhat curved as it passes into seta, brown to sometimes dark purplish when mature, operculum convex, bluntly apiculate; annulus narrow, removable, brown on outside; exothecial cells thin-walled, tending to be rectangular, 3 or 4 rows at mouth of capsule smaller, somewhat flattened and darker-pigmented; stomata phaneropore, pore slit-like; outer peristome teeth yellow, slender, somewhat distant at base, finely papillose, narrowly bordered in upper part, lamellae numerous, proximate; inner peristome delicate, hyaline, basal membrane high, segments slender with narrow openings, so serrate in outline in upper part as to appear appendiculate, finely papillose; spores around 18μ , brownish-yellow, round, slightly roughened. Type locality, Europe.

ILLUSTRATIONS:—Hedw. Sp. Musc. pl. 43; Bry. Eur. pl. 352 (in part); Correns, Untersuchungen, f. 99. 100; Pl. 78.

EXSICCATI:—Aust. Musc. Appal. 188; Holz. Musc. Acro. Bor. Am. 450 (in some sets), 662; Allen, Mosses of Cascade Mts. 54.

Evidently of circumboreal distribution, extending farthest south of the gemmiferous Pohlias: in our eastern states it comes at least as far south as South Carolina, in the west it appears from Alaska through British Columbia and Washington to California. Because it is so frequently sterile it is often passed by unnoticed. With the notes of Loeske, who had observed this group very carefully over a long period of time, it seems now to be fairly clearly distinguished from the other species, his var. *decipiens* having been much confused with *P. prolifera*, as noted above under that species. As to the name, though not myself disposed to discard all knowledge preceding 1801, it seems in this case the only way to reach certainty is to accept Hedwig's use of the name, which is clear, while it had before been used for a variety of species in a way that seems to render impossible a satisfactory application of it. Nor do I see that the matter is improved by discarding it altogether.

19. POHLIA PULCHELLA (Hedw.) Lindb. Musc. Scand. 17. 1879.

Bryum pulchellum Hedw. Descr. 3: 95. pl. 38B. 1792.

Bryum Lescurianum Sull. Mem. Amer. Acad. 4: 171. 1849.

Webera pulchella Schimp. Coroll. 67. 1855.

Plants gregarious to loosely tufted, without noteworthy development of radicles, hardly surpassing 1 cm. in height, generally less, yellowish-green to dirty-green, without lustre; stems simple, slender, erect, the older ones purplish, the younger often yellowish-green; leaves rather numerous, the lower smaller and more distant, lanceolate, entire, the upper gradually becoming longer and more crowded, erect, somewhat flexuose when dry, elongated-lanceolate, slightly toothed in apical region; margin slightly reflexed; costa rather strong, mostly green, percurrent only in elongated upper leaves; cells of leaf-blade thin-walled, long and narrow, up to $10 \times 100 \mu$ and even longer, not notably changed in basal part. Dioicous; ♂ plants generally growing with others and abundant capsules produced; antheridia in terminal buds. Seta slender, generally not above 1 cm. in length, very flexuose and geniculate, reddish in lower part, lighter reddish brown above; capsule normally pendulous, passing into seta with a very strong and abrupt curvature, rather small and short, about 1 mm. long, oval-pyriform with short neck which is much contracted in drying and curving asymmetrically into seta, generally light brown, sometimes darker; operculum convex, apiculate, hard to find in ripe specimens; annulus present, not broad, generally clinging to operculum, from which it is removable in pieces; capsule wall somewhat thin, its exothecial cells thin-walled, somewhat quadrate with wavy outlines, with some 6 or 7 rows of smaller and flattened cells bordering mouth of capsule; stomata numerous, phaneropore, pore slit-like; peristome inserted near mouth, outer teeth well developed, coalesced at base, yellow, very finely papillose, with numerous close lamellae; inner peristome delicate, hyaline, finely papillose, with high basal membrane, segments gaping at keel, cilia well developed, slightly nodulose; spores around 15μ , yellow, papillose, maturing in May. Type locality, Swedish Lapland.

ILLUSTRATIONS:—Hedw. Descr. 3: pl. 38B; Sullivant, Icones Musc. pl. 50 (as *Bryum Lescurianum*); M. H. M. pl. 45.

EXSICCATI:—Aust. Musc. Appal. 190; Sull. Musc. Allegh. 101 (1845, as *B. pulchellum*); Sull. & Lesq. Musc. Bor. Am. 181, (Ed. 2) 273 (as *B. Lescurianum*); Holz. Musc. Acro. Bor. Am. 220; R. & C. Musc. Am. Sept. Exsic. 222 (as *Webera Lescuriana*); Grout, Musci Perfecti 93.

The current interpretation of Hedwig's species has been followed. In Europe the species as now understood is of northern distribution, being almost confined to the Scandinavian peninsula and Finland. In America the case is different, specimens having been seen only with a range from Nova Scotia to the District of Columbia and westward to Michigan, within which range it is common. Specimens from farther west called *P. pulchella* seem, so far as present knowledge goes, to belong to other species. In proposing the new species *B. Lescurianum* Sullivant was misled as in the similar case of his *B. Bigelovii* by Schimper's wrong conception of *B. pulchellum*. No one has yet succeeded in finding a valid difference between the European *P. pulchella* as now understood and the *P. Lescuriana* of North America.

20. POHLIA VEXANS (Limpr.) H. Lindb. Acta Soc. Faun. Flor. Fenn. 16, No. 5: 20. 1899.

Mniobryum vexans Limpr. Laubm. 2: 273. 1892.

Plants gregarious or tufted, with slight development of radicles in lower part, not exceeding 1 cm. in height, yellowish-green to green with more or less lustre; stems simple, slender, stiffly erect, red; leaves numerous, closely arranged, erect, very stiff, not altered in drying, lanceolate, acute, margin reflexed, denticulate; costa strong; red in lower leaves and at base in upper ones, normally percurrent, in lower leaves not always reaching apex; cells of leaf-blade thin-walled, long and narrow, up to $7 \times 85 \mu$.

Inflorescence dioicous, the ♂ plants with others, but not numerous or conspicuous, and capsules generally present; the antheridial buds terminal on short stems. Seta slender, up to 2 cm. in length, curved, light reddish-brown; capsule pendulous, short and small, about 1.5 mm. long, oval-pyriform, with short and inconspicuous neck, walls thin, yellowish-brown; operculum broad convex-apiculate; annulus lacking; exothecial cells with slightly thickened walls, somewhat irregular in size and shape, but isodiametric, with 5 or 6 rows of flattened and slightly darker pigmented cells below mouth of capsule; stomata cryptopore, pore narrowly elliptical, rather large, about 18μ long; teeth of outer peristome yellow, finely papillose, with numerous close lamellae; inner peristome yellowish-hyaline, slightly papillose, with high basal membrane, segments gaping, intervening cilia 2 or 3, slightly nodulose; spores yellow, about 18μ , nearly smooth. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 352 (as *Bryum pulchellum*); Pl. 79B.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 289 (as *Webera pulchella*).

This species, known in Europe from the Alps and Scandinavia, was found by R. S. Williams in 1891 in Montana, and I also note a specimen collected by Leiberg in Idaho, labelled *Webera pulchella*. The National Museum of Canada has several specimens of it, mostly collected by Macoun, one from the Athabasca Plains, collected as early as Sept. 24, 1872, others from points in British Columbia.

21. POHLIA ATROPURPUREA (Wahlenb.) H. Lindb. Act. Soc. Faun. Flor. Fenn. 16, No. 5: 14. 1899.

Bryum atropurpureum Wahlenb. Web. & Mohr, Index Musei Pl. Crypt. 4. 1803. Not *B. atropurpureum* Hüben. and later authors.

Bryum pulchellum ♂ *atropurpureum* Wahlenb. Fl. Lapp. 360. 1812.

Mniobryum atropurpureum Hag. Musc. Norv. Bor. 114. 1901.

Plants gregarious, the least of the genus, rarely over 3 mm. high, reddish-green, without lustre; stems simple, tending to be erect but not much elevated above substratum, often considerably mixed with fine clay or sand; leaves few, closely arranged on short stem, erect and more or less imbricate in comal part, not greatly changed on drying, ovate-lanceolate, acuminate, not decurrent; margin normally reflexed, denticulate in upper part, reddish at base; costa slender, generally red, not percurrent; cells of leaf-blade thin-walled, long rhomboidal-hexagonal, up to $15 \times 70 \mu$. Inflorescence dioicous but regularly and abundantly fruiting. Seta slender above, rather thick below, about 5 mm. in height, sometimes slightly higher up to 1 cm., flexuose, reddish; capsule pendulous, very small, less than 1 mm. long, dark brown, oval, neck nearly obsolete as the capsule seems to pass abruptly into the thickened upper end of the seta; operculum short convex-conical, annulus lacking; exothecial cells thin-walled, somewhat irregular with wavy outline, somewhat smaller and more regular toward mouth of capsule, last rows not much flattened, last 2 rows slightly darker-pigmented; stomata few and hard to make out, phaneropore or nearly so; outer peristome teeth brown, fairly strong, minutely papillose, with numerous close lamellae; inner peristome with high basal

membrane, papillose, yellow, not so fragile as in related species, segments gaping, cilia 1 or 2, rather rudimentary; spores round, 15–18 μ , greenish-yellow, slightly roughened. Type locality, Lapland.

ILLUSTRATIONS:—H. Lindb. l. c. f. 1–15; Pl. 80.

EXSICCATI:—Drumm. Musc. Am. 261 (as *Bryum carneum* var. *pulchellum*); Holz. Musc. Acro. Bor. Am. 292, 599 (last as *Webera gracilis*).

Evidently a circumboreal species, mostly high northern. In America found only in the northwest, from British Columbia to Montana and North Dakota.

22. POHLIA COLUMBICA (Kindb.) n. comb.

Webera columbica Kindb. Mac. Cat. Can. Pl. 6: 115. 1892.

Bryum columbicum Kindb. Eur. & N. Am. Bryin. 386. 1897.

Pohlia decurrens H. Lindb. Act. Soc. Faun. Flor. Fenn. 16, No. 5: 12. 1899.

Mniobryum columbicum Broth. Engler & Prantl, Musci (Ed. 1), 553. 1903.

Plants closely tufted, mostly 1 to 1.5 cm. in height, reddish to quite red, without lustre, rather matted with brown radicles especially in lower part; stems simple or somewhat branched, erect, red, pentagonal in section; leaves numerous, somewhat distant on lower part of stem, close in comal part, stiffly erect, reddish, only the lower ones ovate-lanceolate, the others narrowly lanceolate, long-decurrent, reflexed at margin, rather sharply denticulate with projecting cell-ends; costa rather strong, red, percurrent or ceasing just below the apex; cells of leaf-blade somewhat thick-walled, narrowly linear, up to 7 x 100 μ , in base broader and shorter and more strongly pigmented with red. Inflorescence dioicous; ♂ plants interspersed in small number among others, which then fruit abundantly; antheridia in inconspicuous terminal bud. Seta rather long and flexuose, reddish, in lower part somewhat thick and fleshy, more slender above, about 2 cm. high; capsule pendulous, oval-pyriform, dark red-brown when mature, operculate nearly 2 mm. long, neck rather long compared with related species; operculum high conical, often found attached to capsule; annulus present, pale, attached to operculum, from which it can be removed by pressure; exothecial cells thin-walled, with thickened corners and wavy outline, isodiametric, gradually somewhat smaller toward mouth of capsule, but not markedly flatter or darker-pigmented, though the dark insertion of the peristome teeth shines through; stomata cryptopore; peristome long in proportion to size of capsule, nearly 0.5 mm.; outer peristome teeth yellow with brown insertion, densely papillose, with numerous prominent but not extremely close lamellae; inner peristome pale, hyaline, densely papillose, with high basal membrane, broad segments fenestrate with broad gaps; cilia 2 or 3, long, slightly nodulose, sometimes apparently coalesced; the whole inner peristome tending to be rather persistent and to cling together in conical form; spores brownish yellow, slightly roughened, 15–20 μ , ripening in May. Type locality, British Columbia.

ILLUSTRATIONS:—H. Lindb. l. c. f. 16–25; Pl. 80 B. f. 16–25.

EXSICCATI:—Mac. Can. Musc. 164.

Known at present only from British Columbia, where it was collected in two or three localities by Macoun. The specimen I have used for description was taken at Hastings, April 16, 1889. Lindberg believed, apparently with good reason, that the *Webera pulchella* of the L. & J. Manual (p. 222. 1884) from the Cascade Mts. of British Columbia (Macoun) was also *P. columbica*. Though Kindberg was as unable to identify his own species correctly as he was others, his name is originally so definitely associated with Can. Musc. 164, which is also the type of Lindberg's *P. decurrens*, that it hardly seems necessary to discard Kindberg's name for this apparently distinct but still somewhat critical species.

23. POHLIA CARNEA (L.) Lindb. Musc. Scand, 17. 1879.

Bryum carneum L. Sp. Pl. (Ed. 2) 1587. 1763.

Bryum delicatulum Hedw. Descr. 1: 52. pl. 20. 1787.

Webera carnea Schimp. Coroll. 67. 1855.

Mniobryum carneum Limpr. Laubm. 2: 275. 1892.

Plants gregarious or loosely tufted, sometimes mingled with other mosses, generally not more than 1 cm. in height, yellowish or dirty green, without lustre; stem simple, more or less erect, light reddish; leaves not numerous, rather distant, irregularly spreading and somewhat collapsed and distorted in drying, narrowly ovate-lanceolate, acuminate; margin plane, very slightly denticulate toward apex; costa slender, sometimes slightly reddish in lower part, ending below apex; cells of leaf-blade very large and thin-walled, elongated-rhomboidal, up to 20 x 100 μ , gradually narrowed toward edge of leaf so that they almost suggest

a border. Inflorescence dioicous; male plants mingled with others, which then quite regularly fruit; antheridia in terminal buds. Seta thick and fleshy, on drying grooved and furrowed but not much twisted, rather short, hardly exceeding 1 cm in height, red; capsule pendulous, dark red, short-oval, 1.5 mm. long, neck short, but seta much thickened as it joins neck; operculum convex; annulus lacking; walls of capsule thick, its exothecial cells thick-walled, irregular with wavy outline and thickened corners, strongly flattened in 5 or 6 rows at mouth of capsule but not markedly darker-pigmented; stomata cryptopore; outer peristome teeth brown, large, finely papillose, not bordered, with numerous close lamellae; inner peristome yellow, with high basal membrane, papillose, its segments gaping, its cilia nodulose; spores yellow, about 15 μ , slightly roughened, ripe in May. Type locality, Europe.

ILLUSTRATIONS:—Hedw. Descr. 1: *pl.* 20; Bry. Eur. *pl.* 353 (lower part); Limpr. Laubm. *f.* 273; *Pl.* 79 D.

On wet clay or sandy ground, apparently in the three northern continents, but not reaching the extreme north. Reported in the L. & J. Manual (1884) from Canton, Illinois. H. Lindberg (1899) cast doubt upon its occurrence in America. The only American specimen I have seen was collected by myself (May, 1909) at Ithaca, New York, on wet clayey soil near a brook; it agrees perfectly with the European material. The species probably has in America a distribution similar to that of *P. pulchella*, but is far less common.

24. POHLIA WAHLENBERGII (Web. & Mohr) n. comb.

Hypnum Wahlenbergii Web. & Mohr, Bot. Taschenbuch 280. 1807.

Bryum albicans Wahlenb. (name only, as synonym of above) W. & M. l. c. 1807.

Mnium albicans Wahlenb. Fl. Lapp. 353. 1812.

Bryum Wahlenbergii Schwaegr. Suppl. 1^o: 92. *pl.* 70. 1816.

Webera albicans Schimp. Coroll. 67. 1855.

Pohlia albicans Lindb. Musc. Scand. 17. 1879.

Mniobryum albicans Limpr. Laubm. 2: 277. 1892.

Plants in wide, sometimes loose tufts, sometimes matted with radicles below, frequently up to 5 cm. or even more in height, of a peculiar light or whitish green color, without lustre; stems much elongated, generally branching, the new shoots more or less erect, somewhat reddish in lower part; leaves numerous, distant and somewhat decurrent on stem, irregularly spreading and somewhat contorted in drying, ovate to ovate-lanceolate, acute, margin flat, denticulate by projecting ends of marginal cells in upper part of leaf; costa rather slender, green, hardly reaching apex of leaf; cells of leaf-blade lax and thin-walled, hexagonal-rhomboidal, up to 20 x 100 μ , longer and narrower toward margin. Inflorescence dioicous, plants occasionally fruiting; antheridia in a terminal disk-shaped inflorescence, the outer perigonal bracts with extended horizontal tips; seta 2 cm. or even considerably more in length, slender and flexuose, light brownish-red; capsule oval, 1.5–2 mm. long, sometimes longer, with inconspicuous neck, light to dark brown when ripe; operculum convex-apiculate; annulus lacking; walls of capsule thick, exothecial cells irregular, with thick walls, wavy outline and thickened corners, smaller and flattened but not darker-pigmented in 4 or 5 rows at mouth of capsule; stomata cryptopore, pore narrowly elliptical, about 15 μ long; outer peristome teeth rather slender, yellow brown, papillose, with numerous and fairly close lamellae; inner peristome yellowish, papillose, with high basal membrane, segments gaping, cilia 2 or 3, slightly nodulose; spores 14–18 μ , brownish-yellow, papillose, ripening in summer. Type locality, Europe.

ILLUSTRATIONS:—Schwaegr. Suppl. 1^o: *pl.* 70; Bry. Eur. *pl.* 354 (both as *Bryum Wahlenbergii*); M. H. M. *pl.* 46.

EXSICCATI:—Drumm. Musc. Am. 260 (as *Bryum carneum*); Sull. Musc. Allegh. 100; Aust. Musc. Appal. 189; Sull. & Lesq. Musc. Bor. Am. 182, (Ed. 2) 274; Holz. Musc. Acro. Bor. Amer. 393, 437; Ren. & Card. Musc. Am. Sept. 303; Grout, Musci Perf. 135.

A species of pretty much cosmopolitan distribution, it extends throughout our range, or practically so.

25. POHLIA LONGIBRACTEATA Broth. Bot. Centralbl. 44: 419. 1890.

Bryum longibracteatum Kindb. Eur. & N. Am. Bryin. 384. 1897.

Webera longibracteata Par. Ind. Bryol. (Ed. 1) 1347. 1897.

Mniobryum longibracteatum Broth. Engler & Prantl, (Ed. 1) Musci. 553. 1903.

Webera Lachenaudi Card. & Thér. J. W. Bailey, Bryologist 7: 66. 1904.

Plants gregarious on clayey soil, erect, often branching, up to 2 cm. in height, dirty-green with some red in stem; leaves erect-spreading, long-lanceolate, somewhat reflexed at margin, at least in lower part of leaf, narrowly long-decurrent; marginal teeth very prominent, the cells producing them appearing to have a greater diameter than their neighbors, the cells of the leaf-blade otherwise thin-walled, long and narrow, rhomboidal-hexagonal, up to $15 \times 140 \mu$; costa strong, percurrent or nearly so. Dioicous, but often nicely fruiting; antheridial plants among others, antheridia in terminal disk-like head with much elongated outer bracts; seta slender, flexuose, light brown, 2 cm. or more in length; capsule somewhat unique in shape, subspherical or urceolate, broadening directly from an inconspicuous neck to a diameter of nearly 2 mm., then narrowing to a diameter of less than 1 mm. and from there broadening very slightly to the mouth, its length about 2.5 mm.; it is light brown, with fairly thin walls, rather strongly pigmented dark-brown at the mouth; the exothecial cells in broad part of capsule thin-walled, isodiametric, varying in size, with more irregular wavy contours in narrow part toward mouth of capsule; stomata cryptopore, with small oval pore about 10μ long. The capsules available were deoperculate, the outer peristome teeth mostly broken off; those seen were yellow, papillose, slenderly long-acuminate in upper part; the lamellae very close below, but in slender upper part projecting very prominently and confluent, so that the tooth seen in profile presents here a peculiar saw-like attachment of lighter color and nearly smooth, backed by the thin darker very papillose tooth proper; the inner peristome remains as a more permanent cone over the capsule-mouth; it is light yellow, finely papillose, with basal membrane half the height of the whole, the segments broad, but so folded as to be nearly conduplicate, widely split at keel; cilia inconspicuous, tending to be more or less confluent into a single one; spores round, 14μ , light yellow, finely granular. Type locality, Astoria, Oregon, collected by Röll in 1888.

ILLUSTRATIONS:—Bryologist 7: pl. 9; Pl. 81 A.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 95.

On clay soil, Washington to northern California. I have not seen the type of *P. longibracteata*, which was not fruiting, but I have the drawing of G. Roth, which was obviously prepared from authentic material, and from this and the description there can be no reasonable doubt that it represents the same species as *Webera Lachenaudi*, collected by the late J. W. Bailey near Seattle, Washington, from which I have drawn up the description. In the Herbarium of the New York Botanical Garden there is also a fruiting specimen collected by M. A. Howe near Eureka, California, June 5, 1896, and named, I suppose by Howe himself, *Pohlia longibracteata* Broth., which agrees with the others.

26. *POHLIA TOZERI* (Grev.) Del. Fl. Crypt. Belg. M. 159. 1884.

Bryum Tozeri Grev. Scot. Crypt. Fl. 5: pl. 285. 1827.

Bryum marginatum Bruch, Fr. Müller, Musc. Sard. 1827.

Webera Tozeri Schimp. Coroll. 67. 1855.

Anisostichium Tozeri Mitt. Journ. Linn. Soc. Bot. 7: 119. (1863) 1864.

Epipterygium Tozeri Lindb. Öfv. K. Vet. Ak. Förh. 21: 577. (1864) 1865.

Plants gregarious on bare clay soil, very short, hardly surpassing 5 mm. in height, of a light reddish hyaline color, without lustre; fruiting stems generally shorter than sterile ones, mostly simple, often more or less appressed to substratum, red; leaves not numerous, somewhat distant except the comal ones, spreading, not greatly altered in drying, usually somewhat decurrent, ovate, abruptly acuminate, entire or nearly so; margin plane; leaves on sterile shoots somewhat dimorphous, a dorsal rank of leaves being slightly smaller, especially narrower and hardly decurrent; costa slender, reddish, generally about $2/3$ length of leaf, sometimes slightly forked at end; cells of leaf-blade pellucid, large, with thin walls, rhomboidal, up to $30 \times 120 \mu$, the marginal ones in 3 or 4 rows much narrower, forming a border, which appears slightly darker in color. Inflorescence dioicous, fruiting abundantly; antheridia in terminal buds. Seta somewhat thick and fleshy, pale reddish-brown, often rising from a geniculate base, somewhat flexuose, up to 1.5 cm. long, generally shorter; capsule pendulous, oval-pyriform, hardly more than 1 mm. in length, with a short neck which contracts very much on drying and passes gradually into thickened end of seta, brown when mature; operculum conical, long-pointed, much lighter in color than rest of capsule; annulus well developed, removable; exothecial cells somewhat irregular, tending to be isodiametric, thin-walled with wavy contours, toward mouth of capsule with thicker less wavy walls, last 2 or 3 rows slightly flattened and darker; stomata phaneropore, pore short-elliptical, less than 10μ long; outer peristome teeth yellow with brown insertion, papillose, with lamellae numerous and close except in narrow long-acuminate tip; inner peristome thin,

slightly papillose, with high basal membrane, segments gaping, ending above gap in a long filiform point; cilia long, nodulose, tending to coalesce; spores yellow, about 15 μ , slightly roughened, ripening in spring. Type locality, England.

ILLUSTRATIONS:—Grev. l. c.; Bry. Eur. *pl.* 353 (upper part); *Pl.* 79 A.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 272; Holz. Musc. Acro. Bor. Am. 407, 434.

In Europe the species is an Atlantic and Mediterranean one, in America a Pacific coast plant, extending from Vancouver Island to California. Dimorphism of the leaves is not so marked in our species as in the tropical species on which Lindberg first based his genus *Epityrgium*. Pending more extensive monographical work it seems to me unnecessary to remove it from *Pohlia*.

27. POHLIA FILIFORMIS (Dicks.) n. comb.

Bryum filiforme Dicks. Pl. Crypt. fasc. 4: 16. 1801.

Bryum julaceum Sm. Fl. Brit. 3: 1357. 1804; not Schrad. Spic. Fl. Germ. 70. 1794.

Bryum concinnum Spruce, Trans. Bot. Soc. Edinb. 3: 155. 1849.

Bryum bullatum C. M. Flora 70: 221. 1887.

Anomobryum concinnum Lindb. Öfv. Vet. Ak. Förh. 18: 277. (1861) 1862.

Anomobryum filiforme Husn. Muscol. Gall. 222. 1888.

Anomobryum bullatum Broth. Engler & Prantl (Ed. 1) Musci 563. 1903.

Plants densely tufted, hardly exceeding 1 cm. in height in American specimens, but often much elongated in European ones, yellowish-green with lustre; stems slender, erect, with innovations, tending to be reddish, at least in lower part; leaves numerous, closely arranged on stem, not changed on drying, broadly ovate or oval, obtuse, with plane margin, entire or slightly crenulate with projecting ends of cells in upper part; costa fairly strong below, not reaching apex; cells of leaf-blade varying considerably in different forms, tending to be long-rhomboidal or somewhat vermicular, up to 7 x 100 μ , those of border region thinner-walled and narrower, those of basal region much shorter and broader. Dioicous, generally without fruit; sometimes antheridial plants mingled with others and capsules present; antheridia in terminal gemmiform heads, often with subfloral innovations. Seta slender, up to 2 cm. in height, red, passing to yellow in upper part, somewhat flexuose; capsule horizontal to pendulous, about 4 mm. long, elongated-cylindrical or clavate, light brown, neck nearly as long as rest of capsule; operculum hemispherical, apiculate, darker red-brown; annulus well developed, removable; exothelial cells thick-walled, somewhat elongated but irregular in size and shape, shorter and more pigmented toward mouth of capsule, especially in last 2 or 3 rows; stomata present, phaneropore; outer peristome teeth yellow, darker below, brownish at insertion, finely papillose, slightly bordered above, with numerous close but not prominent lamellae; inner peristome delicate, with high basal membrane, papillose, segments slender and gaping; cilia nodulose or somewhat appendiculate, frequently coalesced; in some cases segments and cilia apparently somewhat reduced; spores yellow, about 14 μ , slightly roughened. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. *pl.* 382 (right, as *Bryum julaceum*); *Pl.* 83 C.

EXSICCATI:—Aust. Musc. Appal. 511; Holz. Musc. Acro. Bor. Am. 43; Ren. & Card. Musc. Am. Sept. 306.

A plant not common, but apparently widely spread over the world, though its exact distribution remains uncertain so long as the value of the various "species" of *Anomobryum* is not fixed. In our range it has been found in the Catskills and Adirondacks of New York, in Wisconsin and Minnesota, Greenland and Arctic America to Alaska. It may well occur more abundantly northward than collections indicate, but is often passed by because it is sterile. In Mexico a so-called variety *mexicanum* (Schimp.) Par. seems to be not uncommon and fruits abundantly.

28. POHLIA CRÜGERI (Hpe.) n. comb.

Bryum Crügeri Hpe., C. M. Syn. 1: 300. 1848.

Bryum Landsbergii Dz. & Mb. Prodr. Fl. Bryol. Surinamensis 40. *pl.* 4. 1854.

Bryum ovalifolium Sull. Proc. Am. Acad. Nat. Sc. 5: 282. (1861) 1862; and probably further synonymy.

Plants gregarious or loosely tufted, sometimes up to 2 cm. in height, normally green, often running into a yellowish- or reddish-green, with a slight lustre; stems somewhat fleshy and thick, irregularly spreading to suberect, extensively branching; leaves rather numerous, distant in lower part of stem, closer above, spreading to erect-spreading when dry, widely spreading when moist, the insertion often at right angles

to stem or nearly so, not decurrent, ovate-lanceolate to ovate, very concave; apex obtuse to acute or even slightly apiculate by projecting costa; margin plane, entire or very slightly denticulate in apical region by projection of cell-ends; costa rather slender, reaching apex or slightly excurrent; cells of leaf-blade narrow-rhomboidal, thin-walled, up to $10 \times 80 \mu$, slightly narrower in marginal region, broad and short in extreme base; purplish propagula sometimes occurring in axils of upper leaves. Dioicous, often without capsules, but sometimes found in fruit; antheridia in terminal bud. Seta slender, normally 1.5 cm., curving, dark red; capsule suberect to pendulous, pyriform-clavate, generally somewhat curved, passing gradually through a neck that may be nearly as long as the rest of capsule into the seta, dark-brown when mature, about 2 mm. long; operculum of lighter color, conical apiculate; annulus present; exothelial cells in upper part of capsule rectangular, moderately thick-walled, elongated, gradually shortened and darker-pigmented near mouth of capsule, but only the final row markedly flattened; stomata prominent, phaneropore; outer peristome teeth dark reddish-brown, darker at base, with prominent lamellae, especially in narrow upper part; inner peristome yellowish hyaline, minutely papillose, with high basal membrane, segments with broad round perforations at keel; cilia appendiculate; spores greenish-yellow, about 14μ , smooth or nearly so. Type locality, Trinidad.

ILLUSTRATIONS:—Dz. & Mb. l. c.; *Pl. 81 B*.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 401.

This is a tropical species, extending from South America through the West Indies to Bermuda. It has been found a few times in Florida, first sterile by S. Rapp (1916) at Sanford, later fruiting by J. B. McFarlin and A. J. Grout near Manatee. It is not closely related to any of the other species of *Pohlia*, but corresponds better in many of its characters with this genus than with *Bryum*.

Besides the species-names included above under *Pohlia* there remain a few which have for one reason or another not been included, which do not however, so far as I can see, add anything to the number of species contained within our territory.

Bryum Bolanderi Lesq. Mem. Calif. Acad. 1: 22. 1869, still included as *Webera Bolanderi* in the L. & J. Manual (1884), was collected by Bolander at the foot of Mt. Dana, California. I have examined the portion of the type in the James Herbarium at Harvard University, but the material is so scant that I have not ventured to dissect it. It has all the appearance of *P. longicolla*. The only thing in the description that would not be consistent with this determination is the characterization of it as dioicous. I do not find any male inflorescence in the material seen. The capsules are rather long-necked, but the peristomes are pretty much worn away. I think the name is best discarded altogether. The material does not in any way indicate a distinct species. Sometimes, as I note later for a Kindberg species, a male plant of some other moss gets mixed in.

Not all of the Kindberg species have been seen, though I have through the kindness of the curators been permitted to examine all the material that could be found in the Kindberg Herbarium at Stockholm and the Macoun Herbarium at Ottawa. Besides the names that are included above as species or synonyms they comprise the following:

Webera canaliculata C. M. & Kindb. Mac. Cat. 6: 113. 1892 I have seen (from Ottawa) in the type specimen collected by Macoun at Salt Spring Island, Vancouver Island, B. C. (Can. Musc. 85). It shows reddish pigmentation suggestive of *P. Schimperii* and seems also in other respects to agree with the latter species. *Bryum nutans* subsp. *Macounii* Kindb. Eur. & N. Am. Bryin. 387. 1897 from Vancouver Island, is apparently the same thing.

Webera microdenticulata C. M. & Kindb. Mac. Cat. 6: 114. 1892 has been examined in what appears to be the type specimen from Ottawa (Can. Musc. 366) collected by Macoun on mountains north of Griffin Lake, B. C. The name was later changed to *Bryum microdontium* Kindb. and (in herb.) to *Webera commutata* var. *microdenticulata*. I see no reason why it should not be included in *P. Drummondii* (= *P. commutata*).

Bryum (Webera) nitescens Kindb. Bot. Not. 1896: 196, earlier called *Bryum nitens* Kindb. (not Hook.) was originally a species name of European material for *Webera cruda* var. *minor* Schimp. (Bih. K. Vet. Akad. Handl. 7, No. 9: 66. 1883). American specimens (from Greenland, Labrador and Lake Louise) named *W. nitescens* by Kindberg, which I received from his herbarium at Stockholm are all characteristic *P. longicolla*.

Bryum subpolymorphum Kindb. Eur. & N. Am. Bryin. 390. 1897, collected by Macoun on Gold Range, north of Griffin Lake, B. C. (Can. Musc. 468) has been examined in the type specimen from the Kindberg Herbarium at Stockholm. Kindberg had earlier called it *Webera cucullata* and then *W. polymorpha*. It has nothing to do with either of them, but is presumably referable to *P. Drummondii*.

Pohlia obtusata Kindb. Rev. Bryol. 32: 37. 1905 was seen in the type specimen from Stockholm, collected by Macoun at Hector, B. C. It is sterile *P. Wahlenbergii* mixed with a *Philonotis*.

Pohlia polygama Kindb. Rev. Bryol. 34: 92. 1907 was also seen in the type specimen from Stockholm, collected by J. M. Macoun at Rosslund, B. C. It was recognized by its author as "allied to *Pohlia nutans*," is in fact identical with it; the subdiscoïd male flowers belong to another moss growing with it.

Bryum cucullatiforme Kindb. Eur. & N. Am. Bryin. 387. 1897 was collected by J. M. Macoun on St. Paul Island in Behring Sea. It was first called by Kindberg (in herb.) *Webera cucullata* and then *W. microcucullata* Kindb. n. sp. I have seen the type from Stockholm and think it is rather *P. cucullata* than *P. nutans*.

Webera microcaulon C. M. & Kindb. Mac. Cat. 6: 114. 1892, collected by R. Bell at Diggers Island, Hudson Strait, Aug., 1884, I have not been able to see, either from Stockholm or Ottawa. The same is true of *Webera fontana* Kindb. Ottawa Naturalist 4: 62. 1890, collected by J. Moser at Canaan Forks, New Brunswick. *Pohlia excelsa* Kindb. Rev. Bryol. 36: 98. 1909, collected by N. L. T. Nelson at Cebolla, Colorado, might be represented in the Herbarium of the Sullivant Moss Society, but I have not succeeded in getting any information about it.

On the species set up by Cardot and his collaborators, Renaud and Thériot, apart from those included above, a few notes follow:

Webera chlorocarpa Card. & Thér. Bot. Gaz. 37: 369. pl. 20. f. 3. 1904, collected by C. F. Baker from stream-bank near Marlette Lake, Washoe Co., Nevada is, in type-material at the New York Botanical Garden, hardly separable from forms of *P. Drummondii*.

Webera pseudogracilis Card. & Thér. Proc. Wash. Acad. Sci. 4: 316. 1902, Trelease No. 2429 from the Harriman Alaskan Expedition, seen in the Herbarium of the New York Botanical Garden, is apparently *P. gracilis*.

Webera Debatii Card. & Thér. Bot. Gaz. 37: 370. pl. 20. f. 2. 1904 I have not seen. It was described from the Herb. Debat without name of collector or of place further than Alexander County, North America. It bore no fruit. In description it was compared with *W. annotina*, but no propagula were mentioned. From description and figure it might be this species, or for that matter various other things. Nothing is lost by consigning it to oblivion.

As to a grouping of species within the genus *Pohlia*, opinions are likely to be somewhat subjective, but the case for the separation of the first 2 species, *P. imperfecta* and *P. Cardoti*, as a group for themselves (*Cacodon* of Lindberg) seems to be a reasonably clear one; they do not appear however to be too closely related to each other. Species 3 to 11 can hardly be divided into two groups, as is often done, but constitute a fairly natural group, though such a species as *P. crudoides* stands pretty much by itself and even *P. cruda* is somewhat removed from the others. The next natural group begins with *P. Ludwigii* and includes the following gemmiferous species through No. 18. These form something of a transition toward *Mniobryum*, but do not connect too closely with it. *P. pulchella* certainly belongs with the species currently included in *Mniobryum* and the treatment of the latter as a genus with exclusion of *P. pulchella* is a taxonomic absurdity, as demonstrated clearly by H. Lindberg. The genus *Epipterygium* is still by some authors included with the *Mniobryum* species and I have provisionally followed this course. *Anomobryum* (*P. filiforme*) does not of course fit into any of the other groups, but is not representative of a very clearly defined genus and seems to me better connected in its characters with *Pohlia* than with *Bryum*. Even its propagula, when it produces any, are of the *Pohlia* type. *P. Crügeri* has no close relationship with any other species and its inclusion in *Pohlia* will doubtless be justly criticized. Its characters seem to me however on the whole to be nearer those of *Pohlia* than of *Bryum*. Some of the exotic groups of *Bryum* are not well placed in it and monographic treatment of the whole material will perhaps sometime permit a more natural segregation of generic units out of the at present poorly understood mass.

As to geographic distribution, it will ere this have become clear that in *Pohlia* as in *Bryum* it is predominantly northern, a majority of the species reaching high latitudes. A large number occur in Greenland and Arctic America. As is frequently the case with northern species, they do not extend far southward in eastern America, so that in our eastern states we have a decided paucity of species of *Pohlia*, as also of *Bryum*. In the west on the other hand they extend well southward in the Rocky Mts. and even farther west, so that the Pacific coast region contains a wealth of species. All our species of *Pohlia* are shared with Europe (and probably most or all with northern Asia) except the tropical American *P. Crügeri* and 3 endemics of our Pacific coast region: *P. Cardoti*, *P. columbica* and *P. longibracteata*.

5. BRACHYMENIUM Schwaegr. Suppl. 2¹: 131. 1824.

Peromnion Schwaegr. Suppl. 3: pl. 250. 1827.

Osculatia DeNot. Mem. Acad. Reg. Sci. Torin., Ser. 2, 18: 445. 1859.

Streblopilum Aongstr. Öfv. K. Vet. Ak. Förh. 33, No. 4: 18. 1876.

Plants of varying size and manner of growth, having the general appearance of species of *Bryum*, usually more or less densely tufted, often matted with brown radicles. Leaves with areolation rhomboidal in upper part, cells generally short-rectangular in basal part. Seta normally long, straight and stiff; capsule erect or suberect, thick-walled; outer peristome normal, with slender teeth; inner peristome more or less

imperfect, often consisting merely of an irregular basal membrane, without segments or cilia, sometimes with rudimentary or imperfect segments or cilia; annulus normally well developed, removable. Type species, *B. nepalense* Hook.

A genus, obviously bryaceous, of the tropics and southern hemisphere, a few species of which reach our southern tier of states. It is characterized especially by its imperfect inner peristome, but there are other species of *Bryum* with imperfect peristome which have not been included in it. Its many species, as is the case with most exotic genera, will be the better for an energetic reduction.

KEY.

- | | |
|---|-----------------------|
| 1. Leaves imbricate, not bordered | 2. |
| Leaves spreading, crispate when dry, bordered | 3. <i>Wrightii</i> . |
| 2. Costa mostly excurrent in a hyaline, sometimes toothed point | 1. <i>systylium</i> . |
| Costa excurrent in a short, smooth, green point | 2. <i>mexicanum</i> . |

1. BRACHYMENIUM SYSTYLIUM (C. M.) Jaeg. Ad. 2: 117. 1874-5.

Bryum systylium C. M. Syn. 1: 320. 1848.

Bryum capillifolium C. M. Syn. 2: 578. 1851.

Bryum capillare Schimp. Besch. Prodr. Bryol. Mex. 50. 1871.

Plants densely tufted, up to 1 cm. or more in height, generally much matted in lower part with brown radicles, green in growing parts, older parts brownish; stems more or less erect, extensively branching, especially by subfloral innovations; leaves numerous, close, sometimes tufted in upper part of stem, closely imbricate and not greatly changed when dry, erect-spreading when moist, oblong-ovate to almost obovate, long-aristate, margin plane to reflexed, entire or slightly crenulate near apex; costa strong, often reddish, especially in lower leaves, generally excurrent in a longer or shorter smooth or more or less toothed arista, in some leaves not reaching the apex, but these leaves aristate like the others; cells of leaf-blade short, thick-walled, rhomboidal-hexagonal in upper part of leaf, $15 \times 35 \mu$, reddish in lower part of leaf, rectangular to quadrate, shorter here in border region, narrower in border region above but without well-defined border. Dioicous, not found fruiting in our range, but occasionally fruiting in Mexico. Seta slender to rather thick and stiff, erect, straight to somewhat flexuose, light to darker brown, 1.5 cm. or more in length; capsule erect to suberect, straight, elongated ovate-clavate, 3-5 mm. in length, generally light brown, sometimes darker, neck slender, passing very gradually into seta, generally not as long as rest of capsule; operculum small, blunt-conical, of darker brownish color; annulus prominent, removable; exothecial cells rather thick-walled, somewhat irregular in size and shape, elongated somewhat except 3 or 4 rows at mouth of capsule, which are more nearly isodiametric and pigmented darker brown; stomata phaneropore; outer peristome teeth slender, red-brown, papillose; inner peristome a yellowish membrane, not reaching high above mouth of capsule, without segments or cilia; spores $15-20 \mu$, round or nearly so, brownish yellow, minutely papillose. Type locality, Mexico.

ILLUSTRATION:—*Pl. 82 A.*

EXSICCATI:—Bartram, Mosses of Southern Arizona 170; Holz. Musc. Acro. Bor. Am. 555.

The species evidently has an extensive synonymy of later names and has been distributed under several such from Mexico, where it is apparently common. It extends through Mexico, Central America and the West Indies into South America, growing especially on the bark of trees. Bartram found it in southern Arizona, in the Santa Rita Mts., in 1922. A specimen collected in the Sacramento Mts. of New Mexico by Wootton in 1899 is apparently the same species. The specimens from the United States are without fruit and depauperate in growth.

2. BRACHYMENIUM MEXICANUM Mont. Ann. Sc. Nat. Bot., Ser. 2, 9: 54. 1838.

Bryum mexicanum C. M. Syn. 1: 252. 1848.

Plants closely tufted, rarely more than 1 cm. in height, generally with considerable development of brown radicles in lower part, green to yellowish-green; stems more or less erect, often branching extensively; leaves numerous, forming a broad tuft on upper part of stem, closely imbricate and not greatly altered in drying, erect when moist, concave, broadly ovate, cuspidate by excurrent costa, margin hardly reflexed, entire, without distinct border; costa fairly strong, sometimes slightly reddish toward base, excurrent in a smooth point, which is green, the apex of leaf gradually narrowing into it; cells of leaf-blade

short, thick-walled, rhomboidal-hexagonal in upper part of leaf with thickened rounded corners, up to $12 \times 50 \mu$, broader and quadrate to short-rectangular with reddish tinge in base. Dioicous, not fruiting in our range, but often fruiting in Mexico. Seta slender and erect, straight or nearly so, up to 3 cm. in height, reddish brown; capsule erect, straight, elongate ovate-clavate, up to nearly 5 mm. in length, brown, neck slender, passing very gradually into seta, not as long as rest of capsule; operculum small, blunt-conical, of darker color than capsule; annulus broad, brown on outside, removable, but clinging somewhat to operculum; exothelial cells thick-walled, irregular, elongated, becoming isodiametric and darker-pigmented toward mouth of capsule; stomata phaneropore; outer peristome teeth slender, reddish brown, paler above, papillose, with relatively few distant, not prominent lamellae; inner peristome a low, delicate membrane with sometimes rudimentary segments or cilia; spores brownish, papillose, 14μ or slightly more. Type locality, Mexico.

ILLUSTRATIONS:—*Pl. 81 C.*

Collected within our range by R. C. Orcutt in May, 1926 at Fort Davis, Texas, identified by Bartram (*Bryologist* 32: 11. 1929). The portion of the specimen which I saw in the Herbarium of the New York Botanical Garden was without fruit and somewhat depauperate, like our specimens of the preceding species, but I should agree with Bartram in placing it in the present species, which seems to me distinct from the other, but hardly so remotely related as to justify placing it in a different section, as is done by Brotherus.

3. BRACHYMENIUM WRIGHTII (Sull.) Broth. Engler & Prantl, Musci (Ed. 1) 559. 1903.

Leptotheca Wrightii Sull. Proc. Am. Acad. 5: 281. (1861) 1862.

Plants closely tufted, up to 2 cm. in height, much matted in lower part with brown radicles, green in growing parts, older parts brownish; stems more or less erect, simple or slightly branched; leaves large, not very numerous, somewhat distant at insertion, loosely spreading and somewhat crispate when dry, slightly decurrent, broadly obovate-spatulate, abruptly cuspidate at apex with toothed somewhat reflexed point; bordered throughout by 3 or 4 rows of linear thick-walled cells which pass into the cuspidate point; margin plane, toothed in upper part; costa fairly strong, not red, often ceasing just below apex without entering cuspidate point; cells of leaf-blade short, thin-walled with walls pitted, ovate-hexagonal in upper part of leaf, about $20 \times 45 \mu$, passing to rectangular in basal part. Dioicous, but generally fruiting, the antheridia, according to Sullivant, occurring in separate minute male plants found about various parts of the female ones. Seta slender, but stiff and erect, straight or somewhat flexuose, light reddish-brown, about 2-3 cm. in height; capsule erect, straight, elongated ovate-cylindrical, about 4 mm. (or with operculum 5 mm.) long, broader toward base, narrowing gradually toward mouth, light tan-color, neck very short and inconspicuous; operculum conical, somewhat elongated, darker in color than rest of capsule; annulus large, removable; exothelial cells irregular, thin-walled, at least 5 or 6 rows at mouth of capsule much shortened and dark-pigmented; stomata rather numerous in neck of capsule, phaneropore, pore elliptical, about 20μ in length; outer peristome teeth long and narrow, dark-brownish, papillose; inner peristome consisting only of a low papillose membrane with very rudimentary incipient segments; spores light brownish, small, about 10μ , spherical or nearly so, slightly granular roughened on surface. Type locality, Cuba.

ILLUSTRATIONS:—*Pl. 82 B.*

A species of the West Indies, which has been found a few times in Florida.

6. PLAGIOBRYUM Lindb. Öfv. K. Vet. Akad. Förh. 19: 606. (1862) 1863.

Zieria Schimp. Coroll. 68. 1855; not Smith, Trans. Linn. Soc. 4: 216. 1798.

Low-growing plants of the *Bryum* type. Stem in section round, with well-defined central strand, other cells including cortical ones rather large and thin-walled. Leaf cells lax and thin-walled. Dioicous; male plants often mingled with others, which may then be found in fruit. Seta rather short and thick; capsule with unusually long neck, clavate and strongly curved, light in color; operculum small, of darker color; peristome double, outer shorter than inner; cilia of inner peristome rudimentary; spores large. Type species, *P. Zierii* (Dicks.) Lindb.

KEY.

- | | |
|---|----------------------|
| Leaves imbricate, whitish | 1. <i>Zierii</i> . |
| Leaves spreading, reddish green | 2. <i>demissum</i> . |

1. *PLAGIOBRYUM ZIERII* (Dicks.) Lindb. Öfv. K. Vet. Akad. Förh. 19: 606. (1862) 1863.*Bryum Zierii* Dicks. Pl. Crypt. fasc. 2: 8. pl. 4. f. 10. 1790.*Pohlia Zierii* Schwaegr. Spec. Musc. 76. 1830.*Zieria julacea* Schimp. Coroll. 68. 1855.

Plants loosely or sometimes densely tufted, not generally exceeding 1 cm. in height, matted with brown radicles below, greenish-white with more or less pinkish tinge and decided lustre; stems erect, branching considerably, especially by subfloral innovations, red or pink; leaves rather numerous, close, imbricate and not much changed in drying, broadly ovate from a narrowed base, very concave, the comal ones longer; margin plane, entire; costa rather strong, reddish, percurrent or nearly so in reflexed leaf-point; cells of leaf-blade large, thin-walled, hyaline, with chlorophyll only in lower part of younger leaves, rhomboidal in upper part of leaf, 20 x 100 μ , shorter and more nearly rectangular in basal part, one or two marginal rows much narrowed to form an indistinct border. Dioicous, antheridial plants often mingled with others and plants fruiting, but also often found without fruit; antheridia in terminal buds. Seta rather short, rarely reaching 1.5 cm., but stout and often much curved, yellow or light brown; capsule suberect to horizontal, much curved, clavate, elongated, up to 5 mm. long, greenish-yellow, neck slender, curved, as long as or sometimes longer than rest of capsule; operculum small, short-conical, somewhat darker than capsule; annulus well developed, clinging somewhat to mouth of capsule; wall of capsule thick and solid, exothecial cells thick-walled, irregular, shortened toward mouth of capsule; stomata numerous, large, phaneropore, pore slit-like; outer peristome teeth shorter than inner, brownish except tips, which are light yellow, rather broad and well developed except as to length, with prominent divisural lines on outer surface, not distinctly papillose; inner peristome light yellowish, with rather high basal membrane; segments very narrow, irregularly slit, cilia rudimentary; spores large, irregularly rounded, 35 μ in greater diameter, brownish yellow, papillose. Type locality, Europe.

ILLUSTRATIONS:—Dicks. l. c.; Hedw. Sp. Musc. pl. 44; Bry. Eur. pl. 341; Pl. 83 A.

EXSICCATI:—Drumm. Musc. Am. 252.

A plant of circumboreal distribution, confined to high latitudes or high altitudes. In our eastern states it has been found in Vermont (at Smugglers' Notch), in the west it extends from Alaska and the Yukon south to Colorado.

2. *PLAGIOBRYUM DEMISSUM* (Hoppe & Hornsch.) Lindb. Öfv. K. Vet. Akad. Förh. 19: 606. (1862) 1863.*Meesia demissa* Hoppe & Hornsch. Flora 2: 106. 1819.*Bryum demissum* Hook. Musc. Exot. 2: pl. 99. 1820.*Pohlia demissa* Hüben. Muscol. Germ. 466. 1833.*Zieria demissa* Schimp. Coroll. 69. 1855.

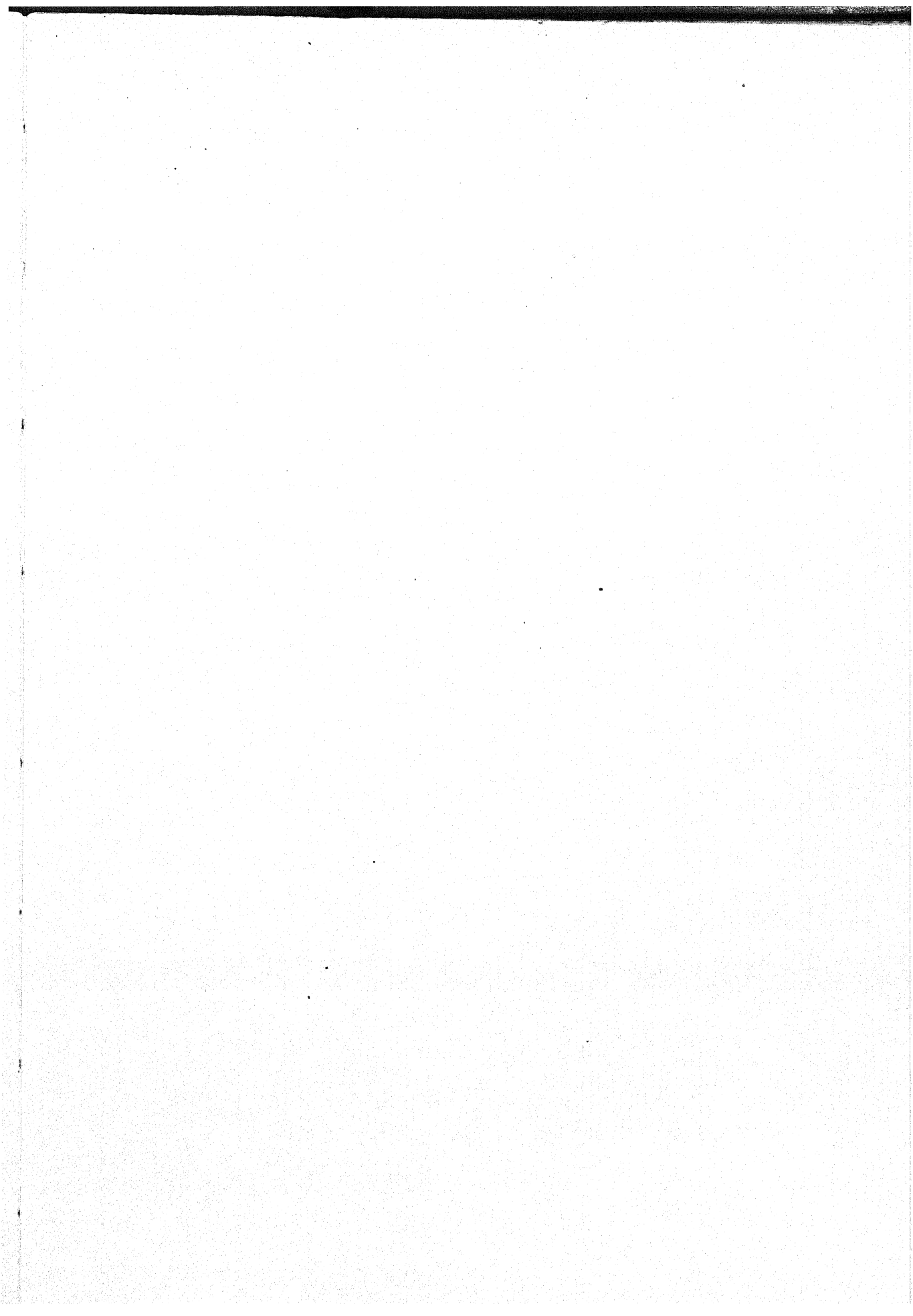
Differs from preceding species in that the plants are short and very closely tufted, the living portion hardly reaching 0.5 cm. in height, green to reddish in color, without lustre. The leaves are more spreading, ovate-lanceolate with a long point, which may be somewhat toothed. Seta and capsule even more curved; annulus removable; outer peristome teeth not so broad or long, rather distant from each other at base, more gradually shading from brownish base to paler apex; inner peristome more solid, with darker brownish pigmentation, its segments narrow and irregular in contour, irregularly slit below, in upper part showing very strong transverse bars, with segments often irregularly connected with each other in upper parts; cilia extremely rudimentary; spores darker brown, still clinging in tetrads when capsule is ripe and deoperculate, finely papillose, individual spores 30–35 μ . Fruiting abundantly when found, probably passing unnoticed when not in fruit. Type locality, Europe.

ILLUSTRATIONS:—Hook. l. c.; Bry. Eur. pl. 341 (lower part); Pl. 83 B.

EXSICCATI:—Drumm. Musc. Am. 250.

Also a plant of circumboreal distribution, but of even higher latitudes and altitudes than the preceding. In America extending from Greenland and the Arctic regions southward in the Rockies to Colorado.

Plagiobryum argenteoides R. S. Williams, Bull. N. Y. Bot. Gard. 2: 29. pl. 21. 1901, sterile, from the Yukon, is, so far as I can see from material kindly furnished by Mr. Williams, quite characteristic *Bryum argenteum* L.



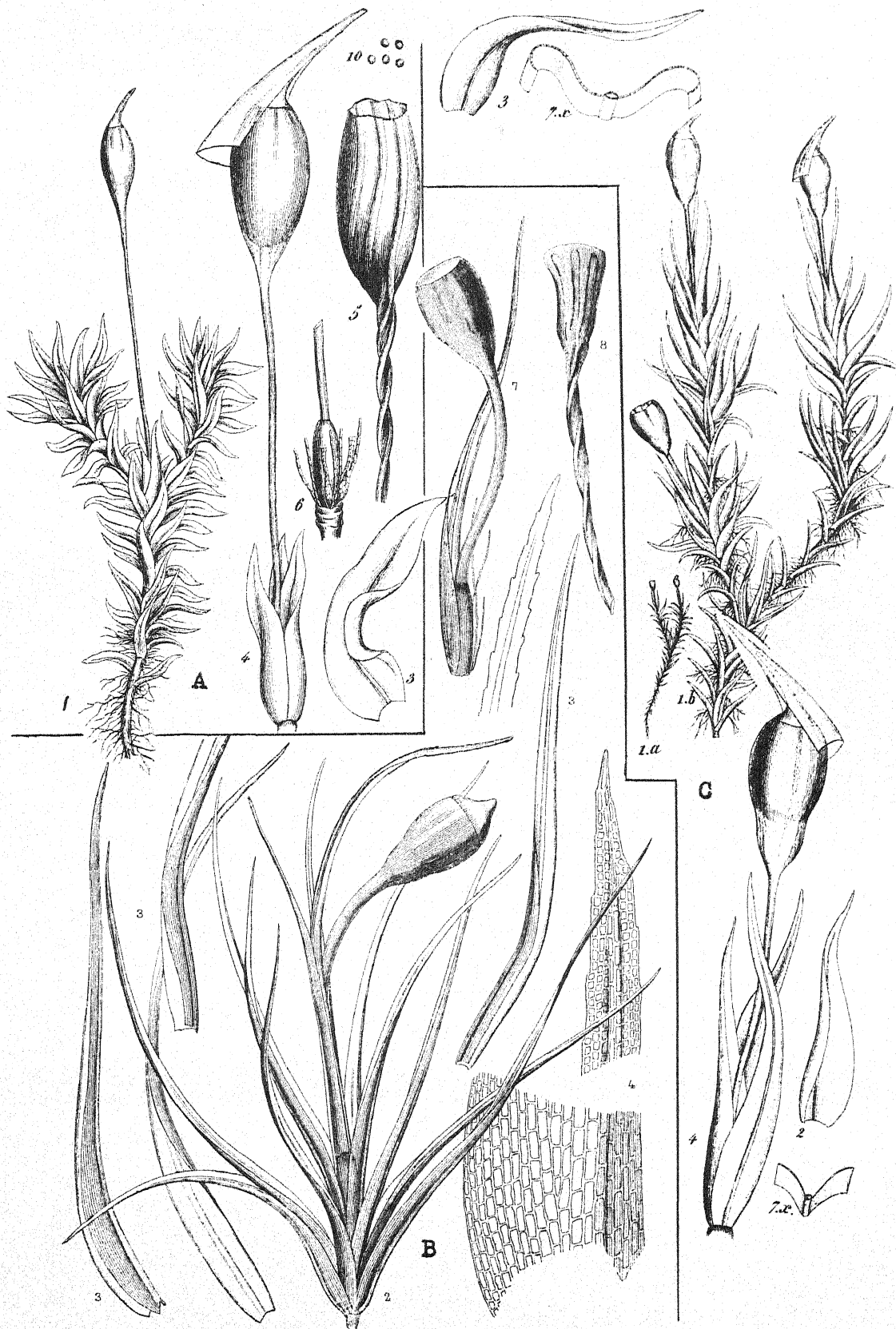


PLATE LVIII.

PLATE 58. A. *Zygodon viridissimus* (from Bry. Eur. pl. 206). 1, plant much enlarged; 3, leaf; 4, perichaetial leaves and sporophyte; 5, dry and empty capsule; 6, vaginula.

B. *Z. californicus* (from Sull. Icones Suppl. pl. 32). 2, part of a stem with capsule and upper leaves; 3, stem leaves; 4, cell structure of base and apex of the same; 7, deoperculate capsule; 8, the same dry.

C. *Amphidium Mougeotii* (from Bry. Eur. l. c.). 1a, plant $\times 1$; 1b, much enlarged; 2 & 3, leaves; 7x, cross sections of a leaf; 4, perichaetial leaves and sporophyte.

PLATE 59. A. *Amphidium Mougeotii*. 1, leaves $\times 60$; 2, perichaetial leaves $\times 60$; 3, apex of perichaetial leaf $\times 600$; 4, apex of stem leaf $\times 600$.

B. *Amphidium lapponicum*. 1, 2, 3, perichaetial leaves from inner outwards $\times 60$; 4, apex of 1 $\times 600$; 5, leaf of var. *crispatum* $\times 60$; 6, leaf apices of var. *crispatum* $\times 600$.

C. *Zygodon viridissimus*. 1, leaf $\times 60$; 2, apex of the same $\times 600$; 3, leaf of var. *rupestris* $\times 60$; 4, leaf apices of var. *rupestris* $\times 600$; 5, brood bodies $\times 300$.

D. *Zygodon conoideus*. 1, leaves $\times 60$; 2 & 3, leaf apices $\times 600$; 4, brood body $\times 300$.

All drawings by Seville Flowers.

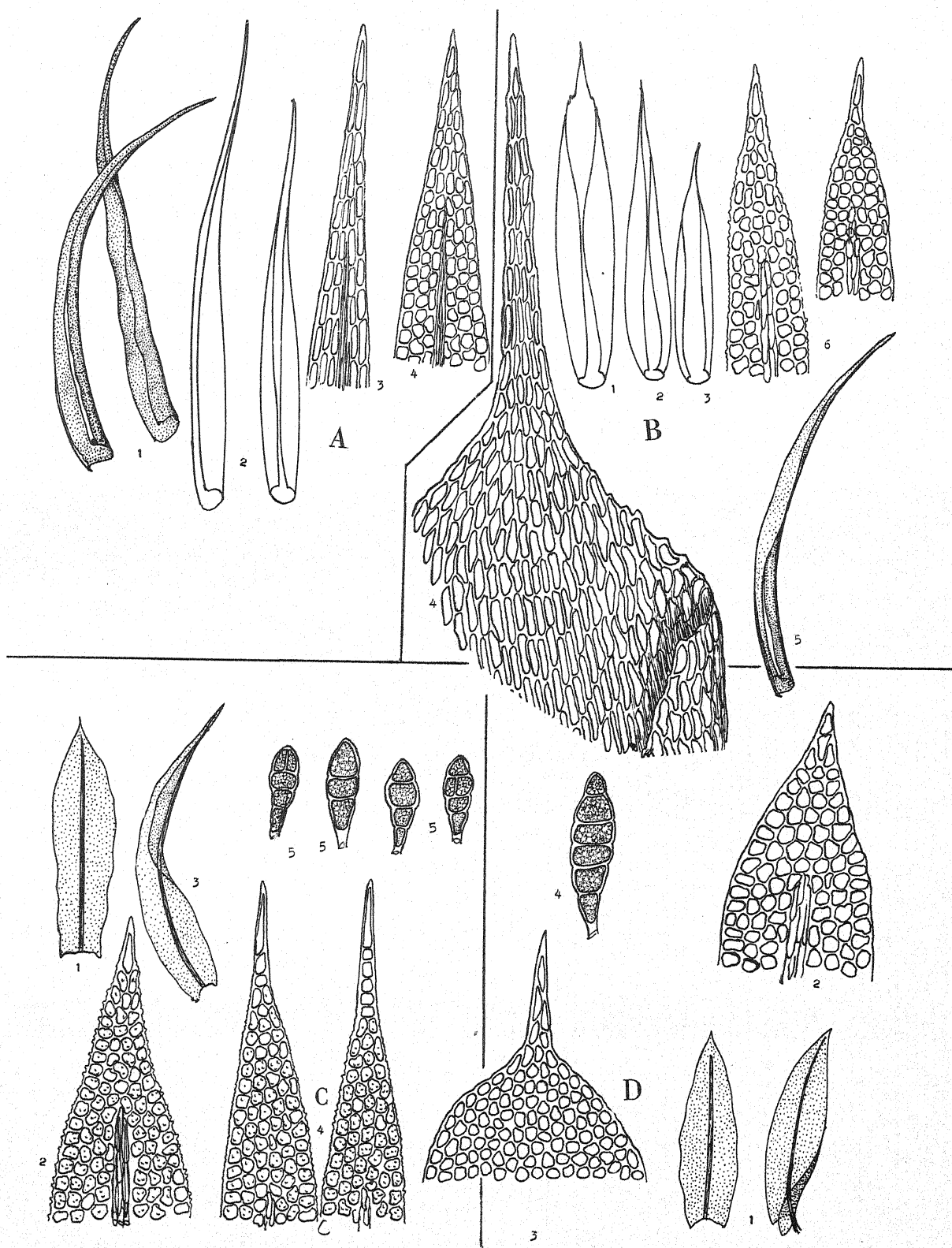


PLATE LIX.



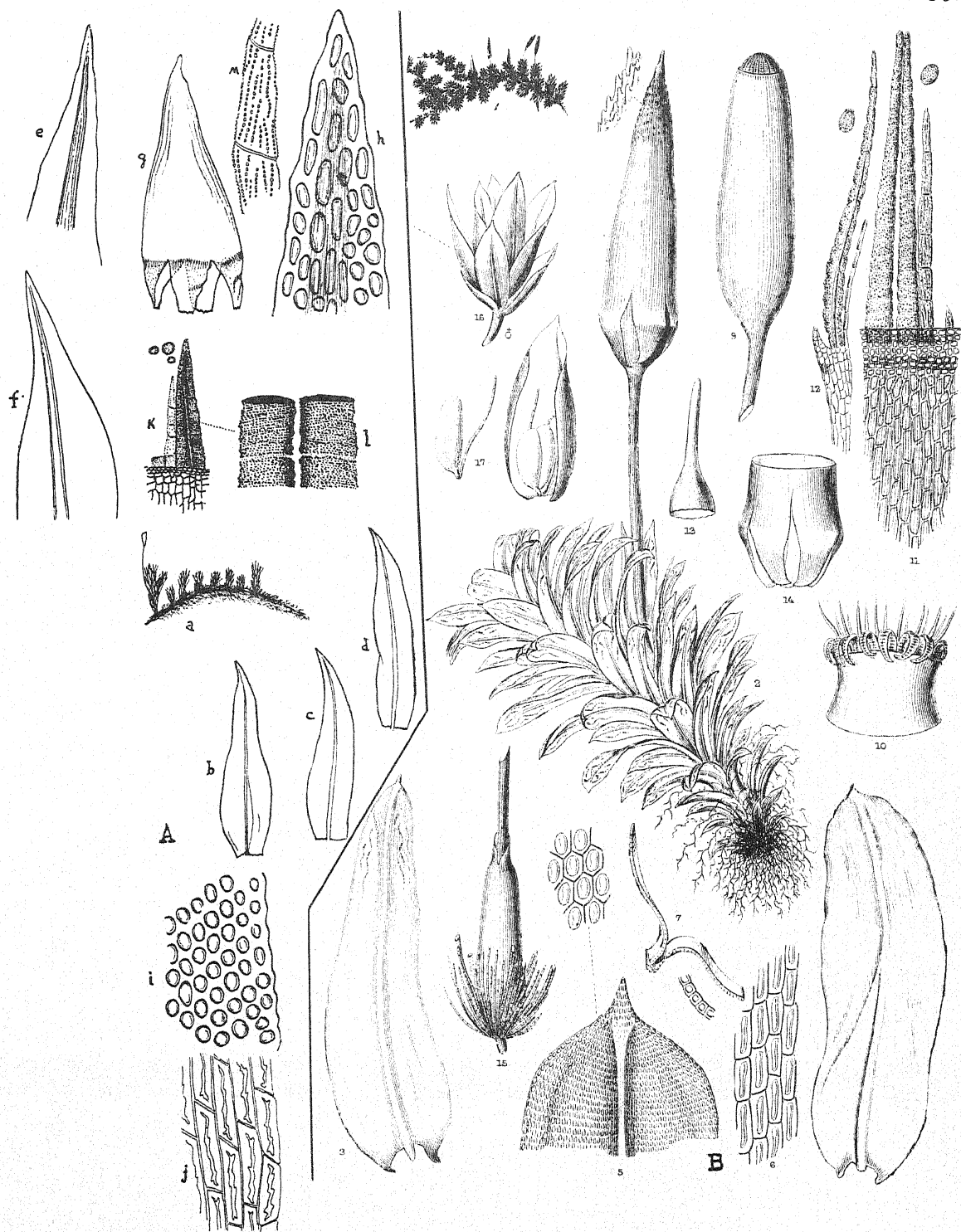
PLATE LX.

PLATE 60. A. *Drummondia prorepens* (from Sull. Icones pl. 33). 2, branch with sporophyte; 3, branch leaf; 5, perichaetial leaf; 6, 7 & 8, leaf cells; 9, cross sections of leaf; 11, operculum with the apex of the columella; 12, opercula; 13, calyptra; 14, part of the peristome with spores; 15, longitudinal section of peristome.

B. *Macromitrium Sullivantii* (from Sull. Icones pl. 37). 1, plant $\times 1$; 2, branch with sporophyte; 3 & 4, leaves; 5, 6, leaf cells; 7, cross sections of leaf; 8, deoperculate capsule; 9, operculum; 10, mouth of capsule showing lack of developed peristome; 11, perichaetium and vaginula.

PLATE 61. A. *Schlotheimia lancifolia* (from the Bryologist 35: pl. 3). *a*, plant $\times 1$; *b*, *c*, *d*, leaves $\times 18$; *e*, *f*, leaf apices more enlarged $\times 80$; *h*, *i*, *j*, apical, median and basal leaf cells respectively $\times 80$; *g*, calyptra $\times 18$; *k*, *l*, peristome $\times 80$ and 480 ; *m*, segment of inner peristome $\times 480$.

B. *Schlotheimia Sullivantii* (from Sull. Icones pl. 38). 1, portion of plant $\times 1$; 2, branch with sporophyte; 3, 4, leaves; 5, apex of leaf; 6, basal leaf cells; 7, cross section of leaf; 9, deoperculate capsule; 10, mouth of capsule with peristome; 11, portion of peristome; 12, longitudinal section of the same; 13, operculum; 14, base of calyptra; 16, 17, antheridial bud and antheridia.



SCHLOTHEIMIA SULLIVANTII, C. Müller.

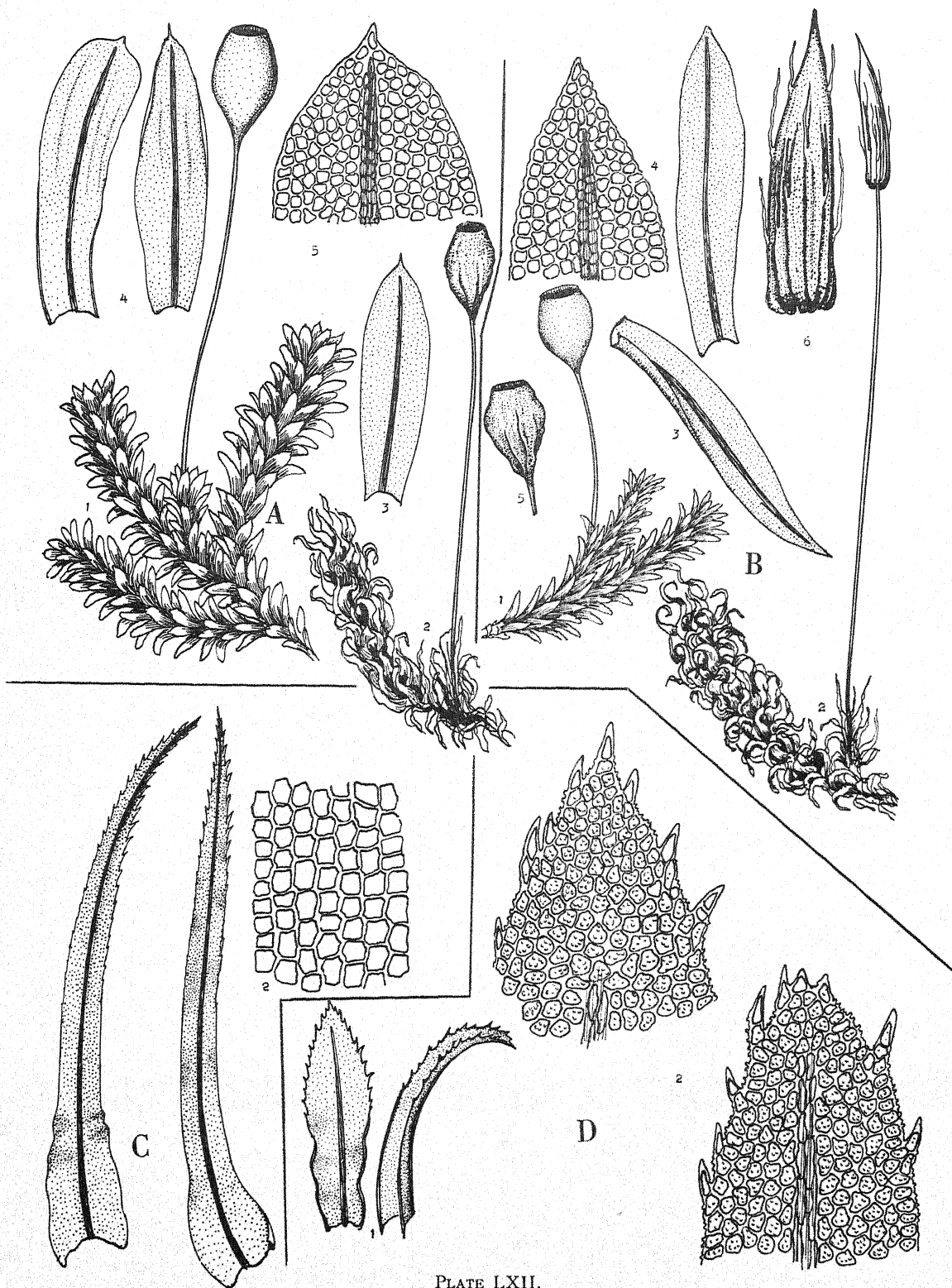


PLATE LXII.

PLATE 62 A. *Macromitrium mucronifolium*. 1, portion of plant $\times 20$, moist; 2, another portion dry $\times 20$; 3, 4, leaves $\times 60$; 5, leaf apex $\times 600$.

B. *M. rhabdocarpum*. 1, portion of moist plant $\times 20$; 2, portion of a dry plant with young sporophyte $\times 20$; 3, leaves $\times 60$; 4, leaf apex $\times 600$; 5, dry capsule $\times 20$; 6, calyptra $\times 60$.

C. *Timmia bavarica*. 1, leaves $\times 20$; 2, median leaf cells $\times 600$.

D. *Zygodon gracilis americanus*. 1, leaves $\times 60$; 2, leaf apices $\times 600$.

All drawings by Seville Flowers.

PLATE 63. A. *Amblyodon dealbatus* (from Bry. Eur. *pl.* 307). 2, plants enlarged; 3, 4, 5, leaves; 3b, leaf apex showing areolation; 7, antheridia and archegonia as produced; 10, capsules; 12, 13, annulus; 14, peristome; 18, stomata.

B. *Paludella squarrosa* (from Bry. Eur. *pl.* 312). 4, ♂ stem; 5, 6, 7, 8, leaves; 9, leaf apex; 5x, cross section of leaf; 12b, apex of perigonal leaf; 16, 17, perichaetial leaves; 17b, apex of the same; 22, moist capsules; 23, dry deoperculate capsule; 27, portion of peristome; 28, side view of peristome tooth; 25, annulus; 29, spores.

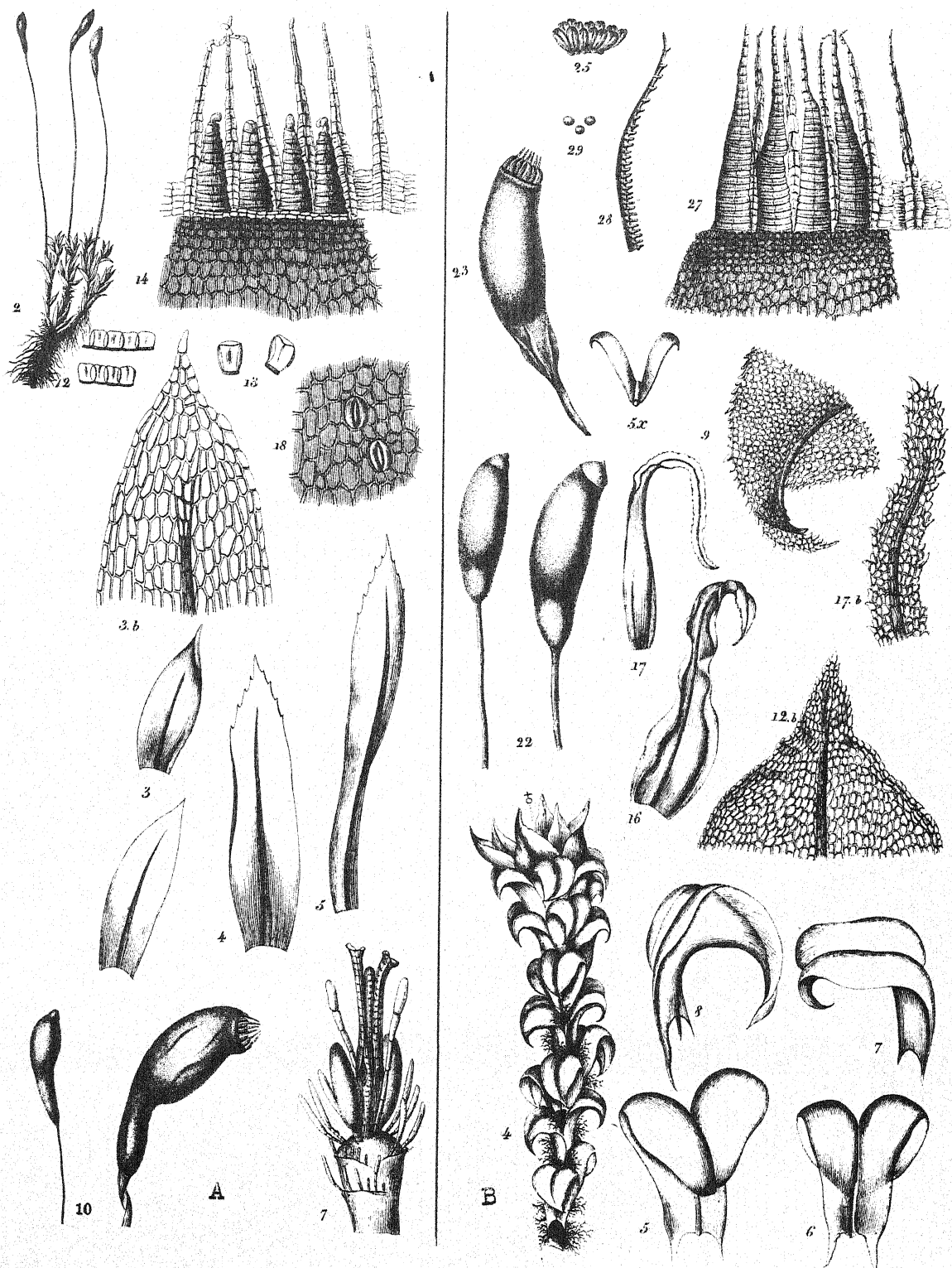


PLATE LXIII.

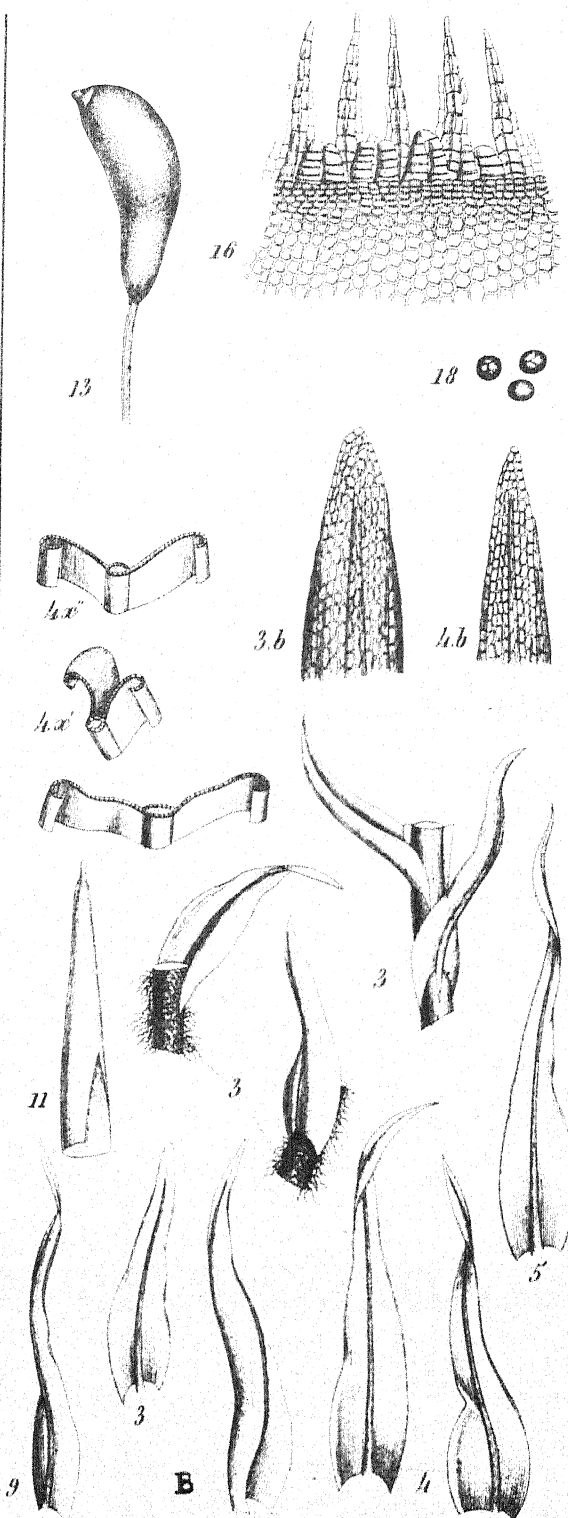
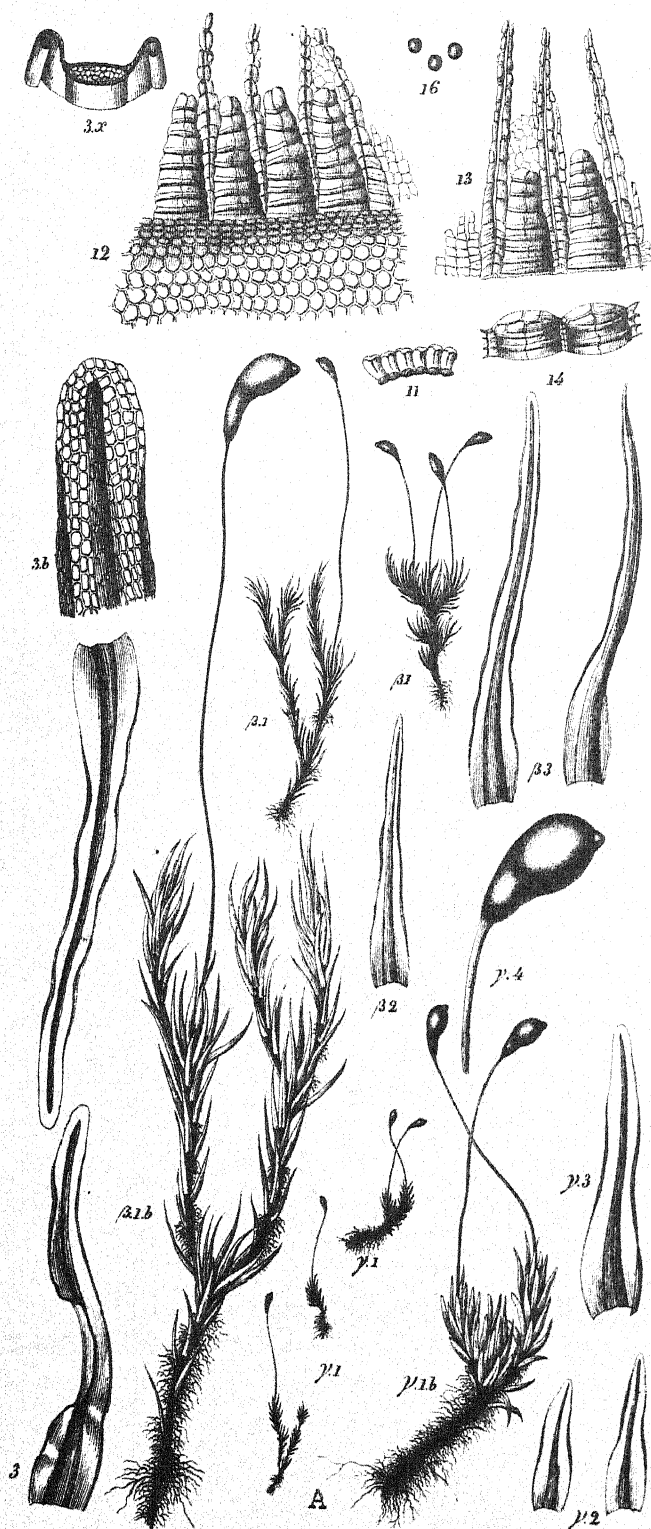


PLATE LXIV.

PLATE 64. *A. Meesia uliginosa* (from Bry. Eur. *pl.* 308). 3, leaves; 3*b*, leaf apex; 3*x*, cross section of leaf; 11, annulus; 12, 13, portions of peristome; β 1, var. *alpina* \times 1; β 1*b*, plant of the same much enlarged; β 2, β 3, leaves of the same; γ 1, var. *minor* \times 1; γ 1*b*, plant of the same enlarged; 2*\gamma*, γ 3, leaves; γ 4, capsule of the same.

B. M. hexasticha (from Bry. Eur. *pl.* 310). 3, 4, 5, leaves; 4*x'*, 4*x''*, cross sections of leaf; 9, perichaetial leaf; 3*b*, 4*b*, leaf apices; 9, perichaetial leaf; 13, capsule; 16, portion of peristome; 18, spores.

PLATE 65. A. *Pohlia Drummondii* (from Bry. Eur. pl. 351, as *Bryum Ludwigii*). 1b, 2b, ♀ and ♂ plants respectively, much enlarged; 3, 4, 5, 6, leaves from the lower to the upper; 4x, 5x, cross sections of leaves; 13, 14, 15, opercula; 16, annulus; 17, deoperculate capsule; 18, portion of inner peristome.

B. *Meesia longiseta* (from Bry. Eur. pl. 309). 3, 4, 5, leaves; 6, upper leaves; 6x, etc., cross sections of the same; 4b, 6b, leaf apices showing areolation; 16, 17, 18, various views of the peristome and teeth; 15, annulus; 19, spores and capsule.

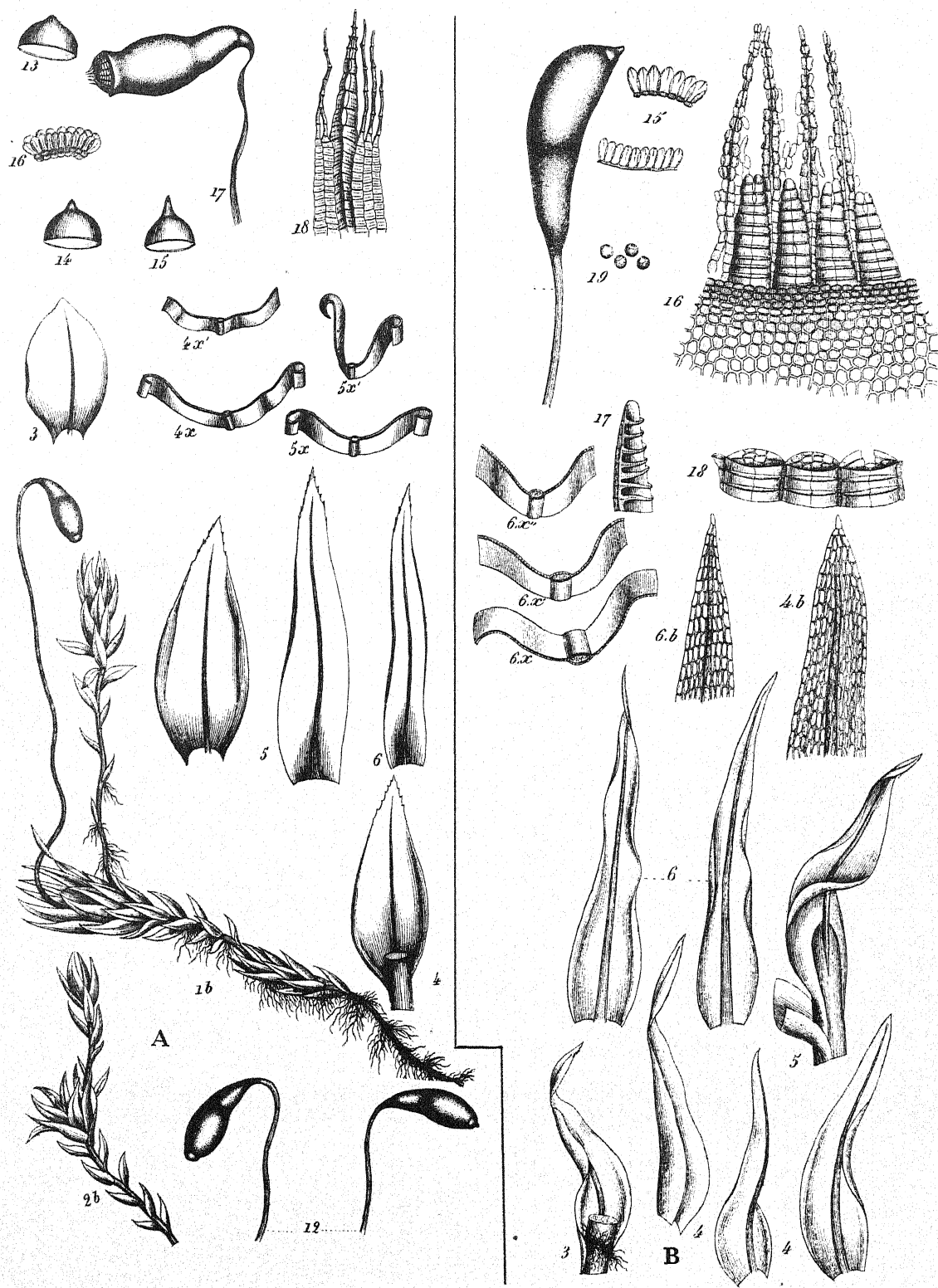
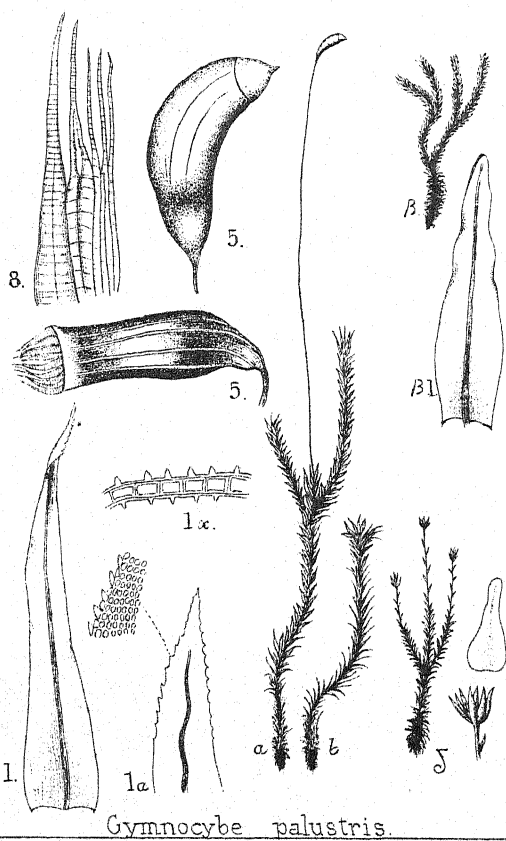
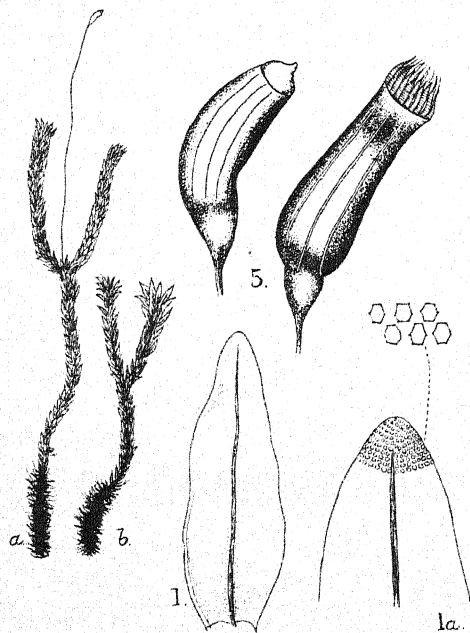


PLATE LXV.

A

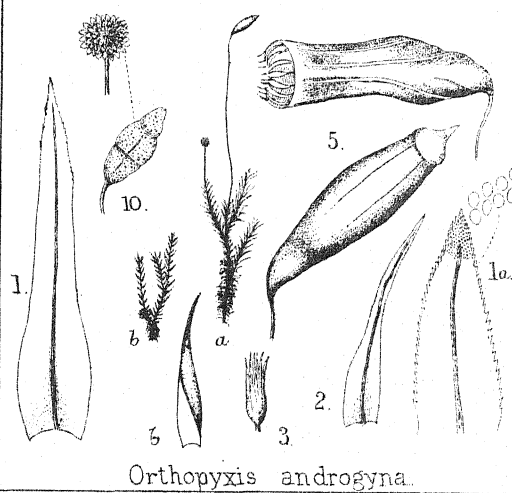


B

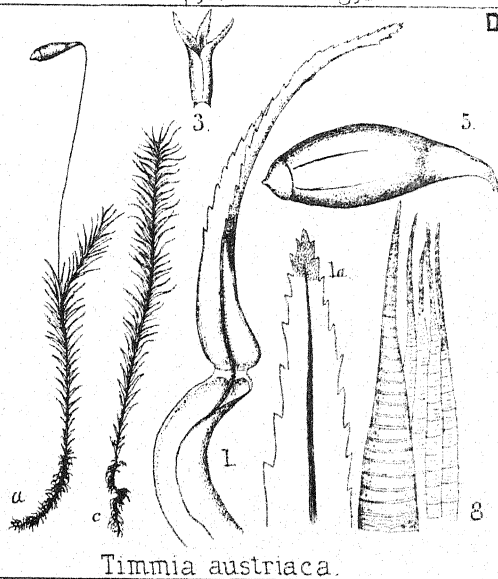


G. turgida.

C

*Orthopyxis androgyna.*

D

*Timmia austriaca.*

E

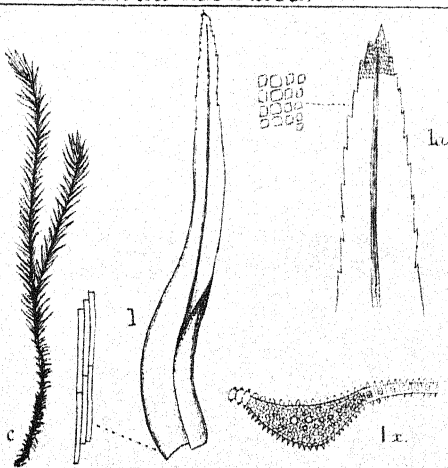
*T. norvegica.*

PLATE 66. (Braithwaite, British Moss Flora 2: pl. 80). A. *Aulacomnium palustre*; β var. *imbricatum*; δ var. *ramosum*.

B. *Aulacomnium turgidum*; C. *Aulacomnium androgynum*; D. *Timmia austriaca*; E. *T. norvegica*.

In this plate *a*, fertile plant; *b*, male; *c*, sterile plant; *i*, leaf; *ia*, leaf apex; *ix*, cross section; *im*, leaf margin; 2, perichaetial leaf; 3, male bud; 5, capsule; 8, peristome; 10, brood body.

PLATE 67. *A. Philonotis gracillima*. 1, habit $\times 1$; 2-3, leaves $\times 20$; 4-5, leaf apices $\times 300$; 6, perigonium $\times 10$; 7, perigonal leaf $\times 20$; 8, perichaetial leaf $\times 20$; 9, portion of the stem $\times 5$; 10, capsule $\times 10$.

B. Ph. glaucescens. 1, leaf of var. *terrestris* $\times 20$; 2, leaves of var. *brevifolia* $\times 20$; cells $\times 300$.

C. Ph. longiseta forma *polygama*. 1, portion of the stem, showing synoicous and autoicous flowers on the same plant, $\times 3$; 3, synoicous inflorescence $\times 20$; 3, autoicous inflorescence $\times 20$.

D. Bartramidula Carolinae. 1, habit $\times 1$; 2, portion of the stem $\times 5$; 3, leaves $\times 20$; 4, synoicous inflorescence $\times 20$; 5-6, moist and dry capsules $\times 10$.

E. Caloscopium nigrum. 1-2, habit $\times 1$; 3-4, leaves $\times 20$; 5, leaf apices $\times 300$; 6-7-8, capsules moist and dry; 1-10, peristome teeth $\times 75$; 11, perigonal leaf $\times 20$; cells $\times 300$.

F. Conostomum boreale. 1, habit $\times 1$; 2, leaves $\times 20$; 3, leaf apex $\times 300$; 5, capsules moist and dry $\times 10$; 5, peristome teeth united by their tips $\times 75$; cells $\times 300$.

G. Plagiopus Oederi. 1, habit $\times 1$; 2, leaves $\times 20$; 3, leaf apex $\times 75$; 4, leaf apex $\times 300$; 5, cross section of the stem $\times 10$; 6-7, capsules moist and dry $\times 10$; 8, portion of the peristome $\times 75$; cells $\times 300$.

H. Bartramia ithyphylla. 1, habit $\times 1$; 2, leaves $\times 20$; 3, leaf sections $\times 300$; 4, capsule $\times 10$; 5, peristome teeth $\times 75$.

I. B. breviseta. 1, habit $\times 1$; 2, leaf $\times 20$; 3, leaf section $\times 300$; 4, peristome teeth $\times 75$.

J. B. microstoma. 1, habit $\times 1$; 2, capsule $\times 10$; 3, peristome teeth $\times 75$; Note; the leaves are like those of *B. viridissima*, which see.

K. B. stricta. 1, habit $\times 1$; 2, habit $\times 4$; 3, leaves $\times 20$; 4, peristome teeth $\times 75$; cells $\times 300$.

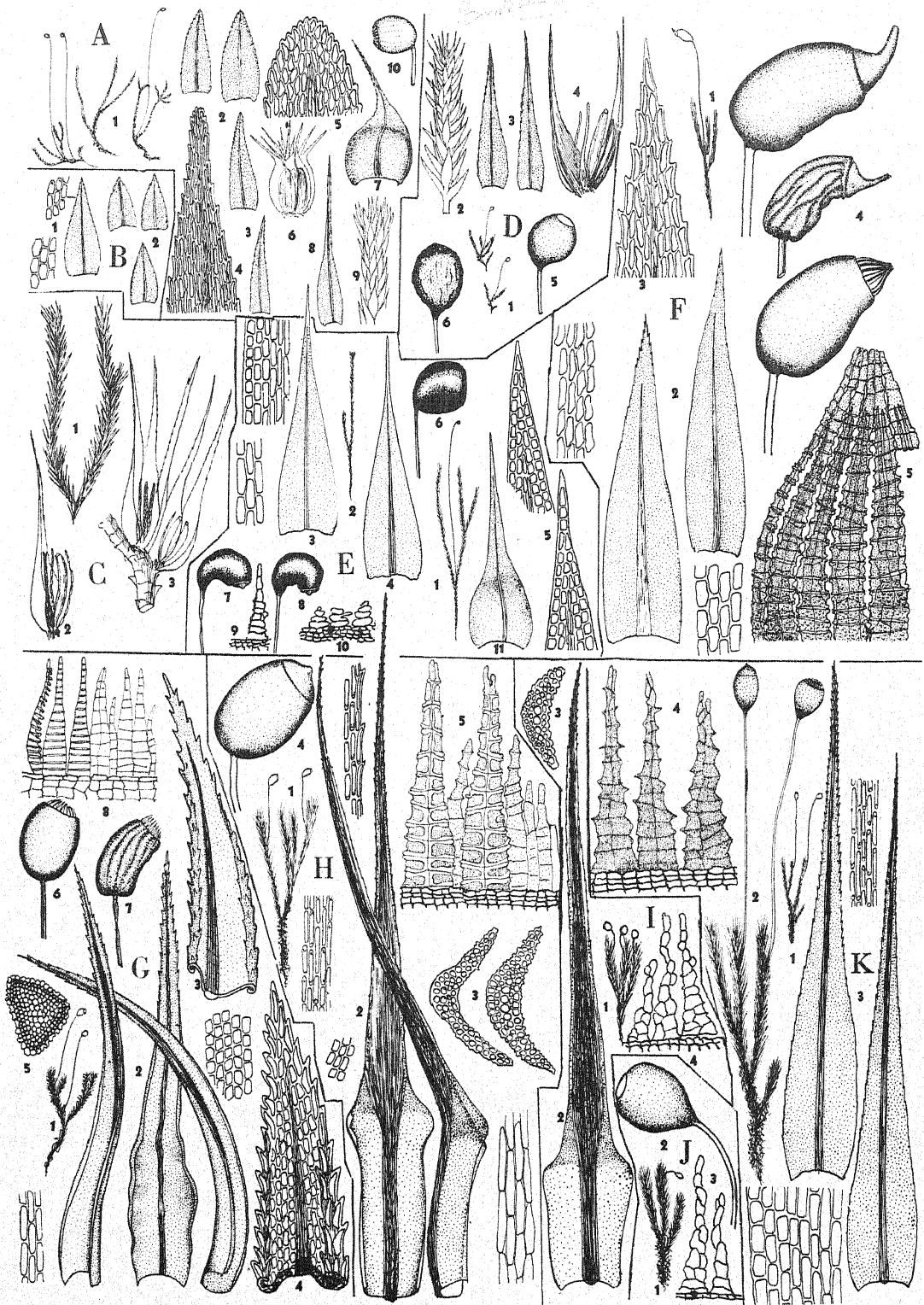


PLATE LXVII.

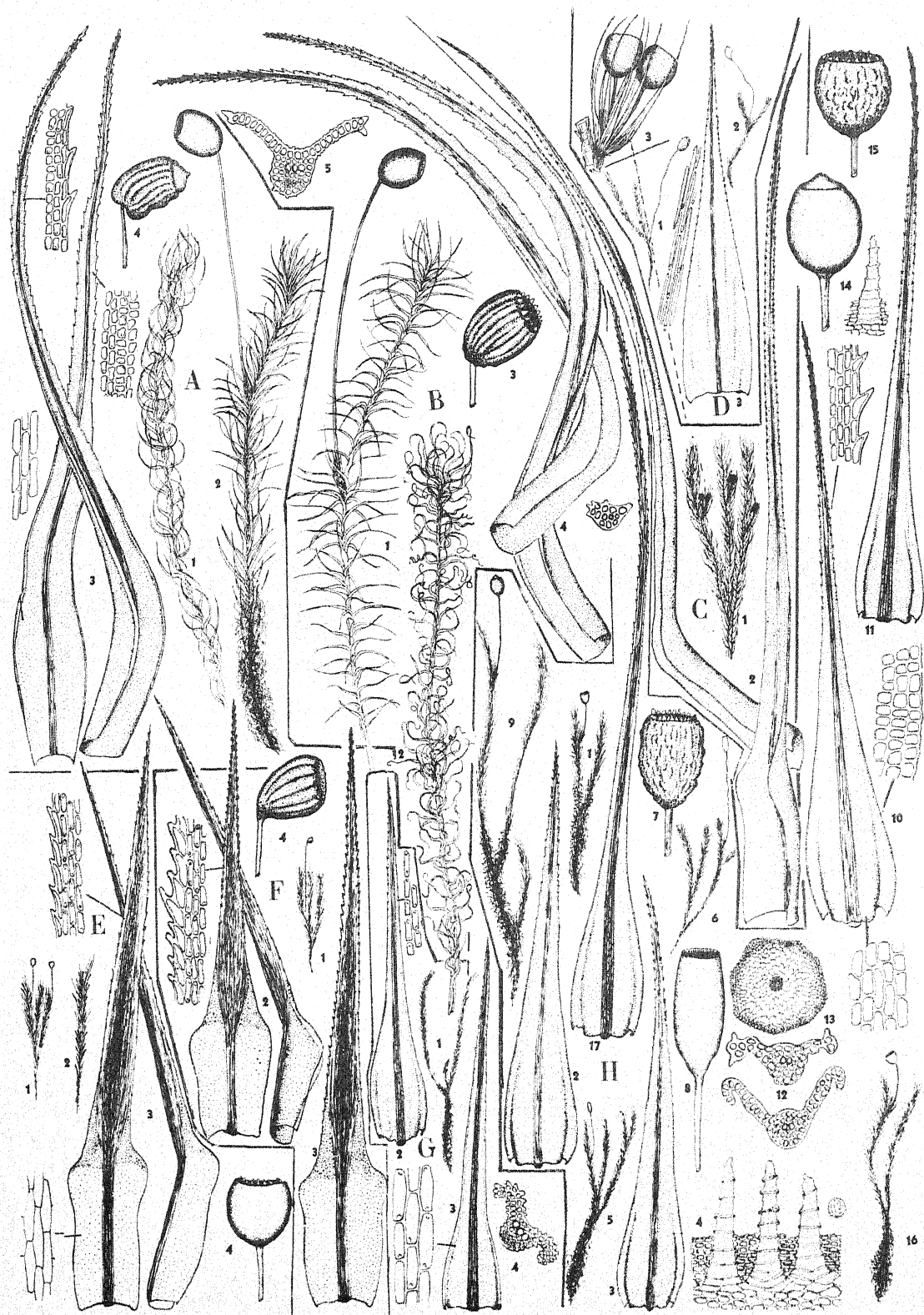


PLATE LXVIII.

PLATE 68. A. *Bartramia glauco-viridis*. 1, habit dry $\times 5$; 2, habit moist $\times 5$; 3, leaves $\times 20$; 4, capsule $\times 10$; cells $\times 300$.

B. *B. circinulata*. 1, habit moist $\times 5$; 2, habit dry $\times 5$; 3, capsule dry $\times 5$; 4, leaves $\times 20$; 5, leaf section $\times 300$.

C. *B. Halleriana*. 1, habit $\times 1$; 2, leaves $\times 20$; 3, capsules $\times 5$.

D. *Breutelia Mohriana*. 1-2, habit $\times 1$; 3, leaf $\times 20$; cells $\times 300$.

E. *Bartramia viridissima*. 1, habit $\times 1$; 2, stem with broken leaves $\times 2$; 3, leaves $\times 20$; 4, capsule $\times 10$; cells $\times 300$.

F. *B. glauca*. 1, habit $\times 1$; 2, lower leaves $\times 20$; 3, upper leaf $\times 20$; 4, capsule dry $\times 10$; cells $\times 300$.

G. *Anacolia laevisphaera*. 1, habit $\times 1$; 2-3, leaves $\times 20$; 4, leaf section $\times 300$; cells $\times 300$.

H. *Anacolia*. 1-4 *A. Menziesii*. 1, habit $\times 1$; 2-3, leaves $\times 20$; 4, peristome teeth $\times 75$. 5-8, *A. Menziesii* var. *Baueri*. 5-6, habit $\times 1$; 7, capsule dry $\times 10$; 8, capsule moist $\times 10$. 9-15, *A. Menziesii* var. *Baueri* f. *grandifolia*. 9, habit $\times 1$; 10-11, leaves $\times 20$; 12, leaf sections $\times 300$; 13, stem section $\times 150$; 14, capsule moist $\times 10$; 15, capsule dry $\times 10$. 16-17, *A. aristifolia*; 16, habit $\times 1$; 17, leaf $\times 20$; cells $\times 300$.

- PLATE 69. A. *Philonotis fontana* var. *falcata*. 1, habit $\times 1$; 2-3, various forms of leaves from different plants $\times 20$; 4-5-6, perigonal leaves $\times 20$; 7, portion of the stem $\times 5$.
- B. *Ph. caespitosa*. 1, habit $\times 1$; 2, two forms of leaves from different plants $\times 20$; 3, perigonal leaf $\times 20$; cells $\times 300$.
- C. *Ph. caespitosa* var. *laxa*. 1-2 habit $\times 1$; 3, portion of the stem $\times 5$; 4-5, leaves $\times 20$.
- D. *Ph. caespitosa* var. *adpressa*. 1, habit $\times 1$; 2, portion of stem showing habit of leaves $\times 10$; 3-4-5, upper, middle and lower leaves respectively $\times 20$; cells $\times 300$.
- E. *Ph. caespitosa* var. *compacta*. 1, habit $\times 1$; 2, portion of the stem $\times 5$; 3-4, leaves $\times 20$; cells $\times 300$.
- F. *Ph. fontana* var. *seriata* forma *occidentalis*. 1, habit $\times 1$; 2, leaves $\times 20$.
- G. *Ph. marchica*. 1, habit $\times 1$; 2, leaves $\times 20$; 3, perigonal leaf $\times 20$; cells $\times 300$.
- H. *Ph. Muhlenbergii*. Leaves $\times 20$, cells $\times 300$.
- I. *Ph. capillaris*. 1, habit $\times 1$; 2-3, small-leaved form $\times 20$; 4-5, larger-leaved form $\times 20$; 6, perigonal leaf $\times 20$; cells $\times 300$.
- J. *Ph. sphaericarpa*. 1, habit $\times 1$; 2, leaves $\times 20$; 3, perigonium $\times 20$; 4-5, perigonal leaf $\times 20$; 6, var. *terrestris* leaves $\times 20$; cells $\times 300$.
- K. *Ph. longiseta*. 1, habit $\times 1$; 2-3, leaves $\times 20$; 4, perichaetium $\times 20$; 5, perigonal leaf $\times 20$; 6, perigonium $\times 20$; 7, perichaetial leaf $\times 20$; cells $\times 300$, 8, portion of the stem $\times 5$.
- L. *Ph. longiseta* forma *propagulaeaulis*. 1, habit $\times 1$; 2, portion of the stem $\times 5$; 3, brood body $\times 20$.
- M. *Ph. uncinata*. 1, habit $\times 1$; 2-3, leaves $\times 20$; 4, perichaetial leaf $\times 20$; 5, perigonium $\times 10$; 6, perigonal leaf $\times 20$; 7-8, capsules moist and dry; $\times 10$; cells $\times 300$.
- N. *Ph. glaucescens*. 1, habit $\times 1$; 2, leaves $\times 20$; 3-4, perigonal leaves $\times 20$.



PLATE LXIX.

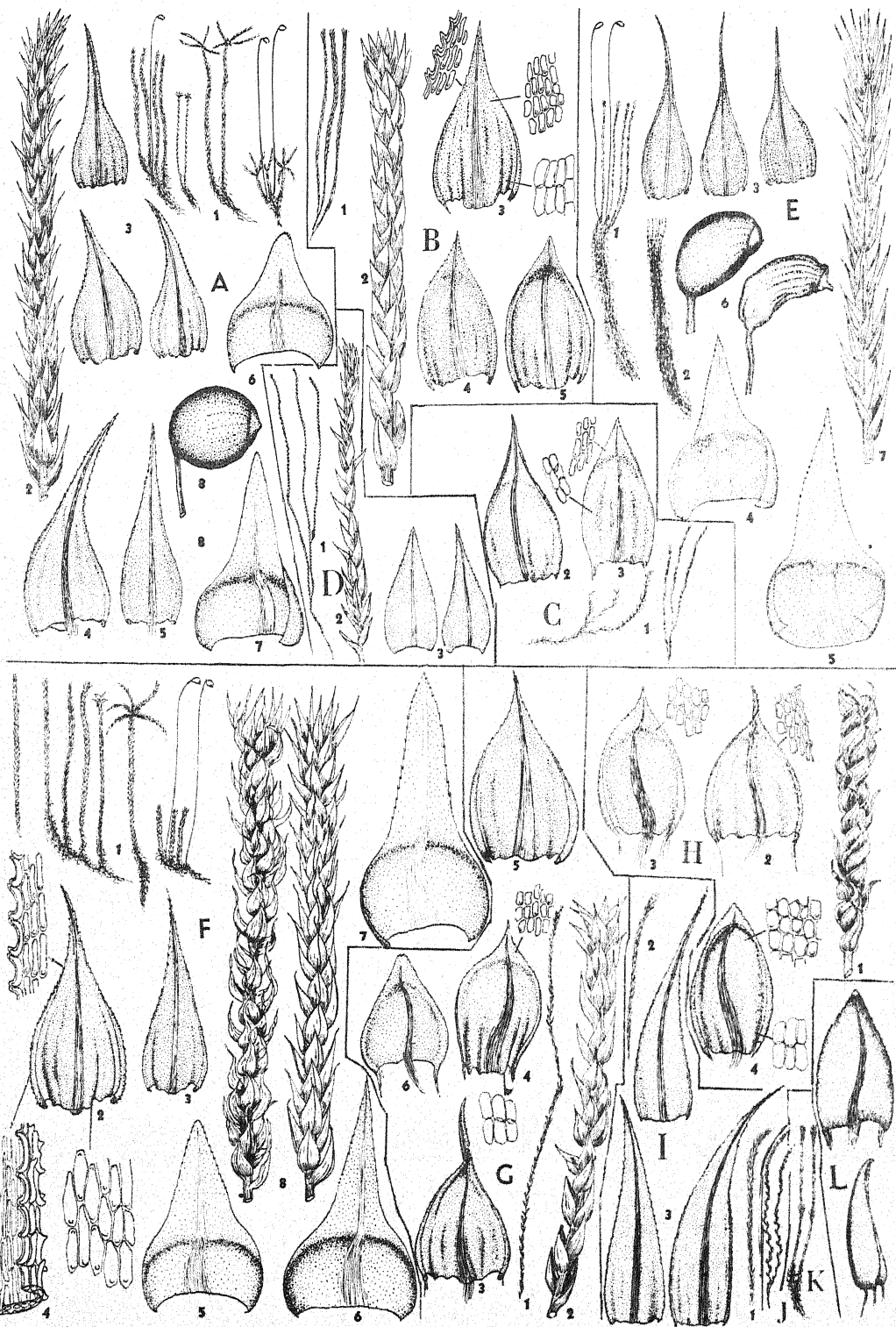


PLATE LXX.

PLATE 70. A. *Philonotis fontana*. 1, habit $\times 1$; 2, portion of a typical stem $\times 5$; 3, three leaves of average size $\times 20$; 4, broad leaf form $\times 20$; 5, leaf of male branch $\times 20$; 6-7, perigonal leaves $\times 20$; 8, mature moist capsule $\times 10$; cell details $\times 300$.

B. *Ph. fontana* var. *adpressa*. 1, habit $\times 1$; 2, portion of the stem $\times 5$; 3-4-5, upper, middle and lower leaves respectively $\times 20$; cells $\times 300$.

C. *Ph. fontana* var. *laxa*. 1, habit $\times 1$; 2-3, upper and lower leaves respectively $\times 20$; cells $\times 300$.

D. *Ph. fontana* var. *laxa* forma *tenuis*. 1, habit $\times 1$; 2, portion of the stem $\times 5$; 3, leaves $\times 20$.

E. *Ph. fontana* var. *pumila*. 1-2, habit $\times 1$; 3, leaves $\times 20$; 4-5, perigonal leaves $\times 20$; 6, capsules moist and dry respectively $\times 10$; 7, portion of the stem $\times 5$.

F. *Ph. americana*. 1, habit $\times 1$; 2, typical stem leaf $\times 20$; 3, leaf of male branch $\times 20$; 4, lower margin $\times 300$; 5-6-7, perigonal leaves $\times 20$; 8, portion of the same stem dry and moist $\times 5$; cells $\times 300$.

G. *Ph. americana* forma *laxa*. 1, habit $\times 1$; 2, portion of the stem $\times 5$; 3-5, upper leaves; 4-6, lower leaves $\times 20$; cells $\times 300$.

H. *Ph. americana* var. *torquata*. 1, portion of the stem dry $\times 5$; 2-3-4, upper middle and lower leaves respectively $\times 20$; cells $\times 300$.

I. *Ph. calcarea* forma *occidentalis*. 1-2, habit $\times 1$; 3, leaves $\times 20$.

J. *Ph. fontana* var. *heterophylla*. Habit sketch of co-type from Alaska $\times 1$.

K. Habit sketch of *dimorphophylla* forms $\times 1$.

L. *Ph. fontana* var. *borealis* leaves $\times 20$.

PLATE 71. A. (From Bull. Torr. Bot. Club. 54: 32). *Mielichhoferia macrocarpa*. 1, Male plant $\times 1$; 2-5, leaves $\times 20$; 6, cross section from lower half of costa $\times 300$; 7, cross section from upper half of costa $\times 300$; 8, cross section of leaf margin $\times 300$; 9, one side of leaf base $\times 100$; 10, apex of leaf $\times 100$; 11, median leaf cells $\times 300$; 12, dry, partially deoperculate capsule $\times 8$; 13, two peristome teeth $\times 100$; 14, 15, two leaves from Drummond's Musc. Amer. no. 74.

Figures 16-20. *Mielichhoferia cuspidifera* Kindberg. 16-18, three leaves $\times 20$; 19, apex of leaf $\times 100$; 20, median leaf cells $\times 300$. A mistake, probably *Bryum capillare*.

B. *Mielichhoferia Mielichhoferiana* (from Bry. Eur. pl. 328). 1, 2, plants $\times 1$; 2b, fertile plant with dry capsule; 4b, ♂ plant; 6, leaf; 6a, 6b, cells of apex and base of the same; 14, perichaetial leaf, also capsule with calyptra; 20, peristome; 23, annulus.

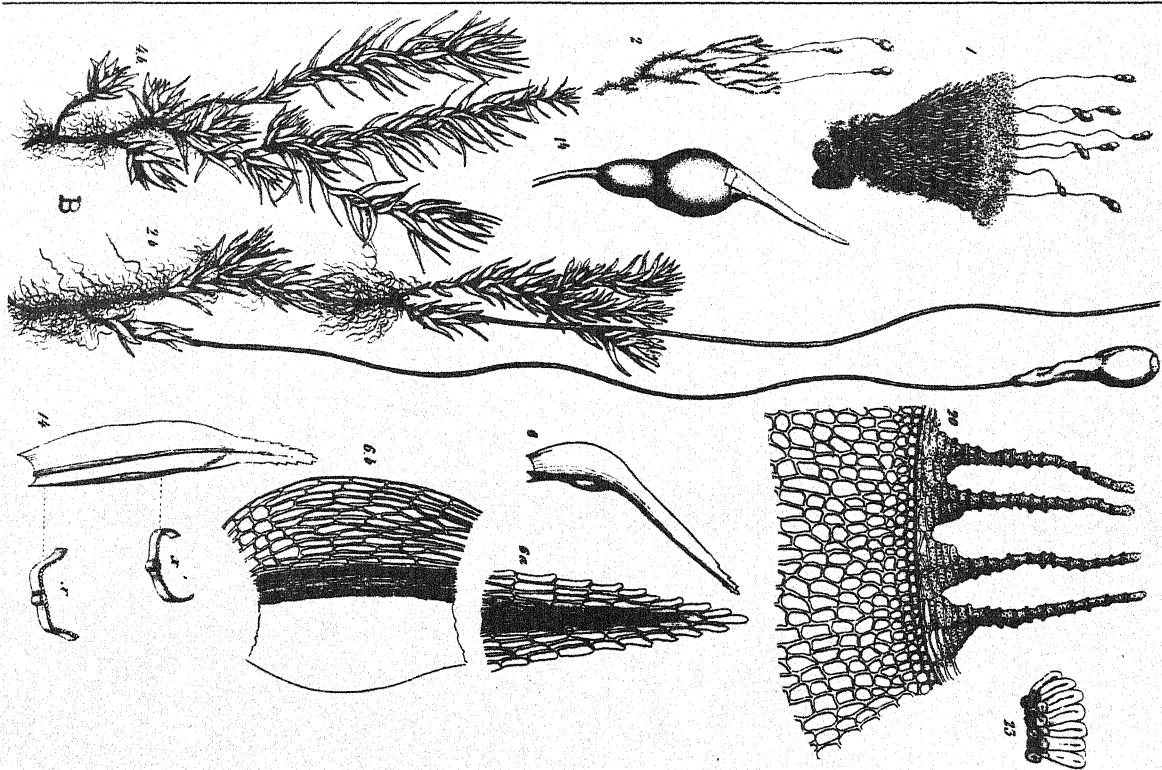
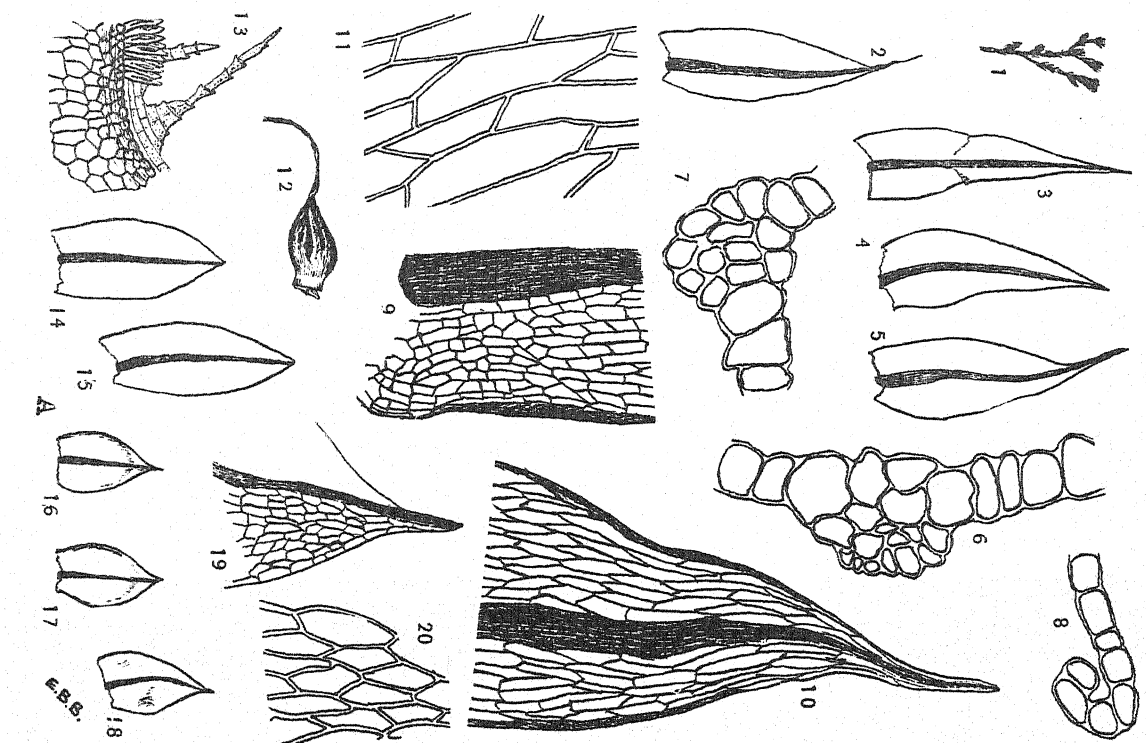


PLATE LXXI.

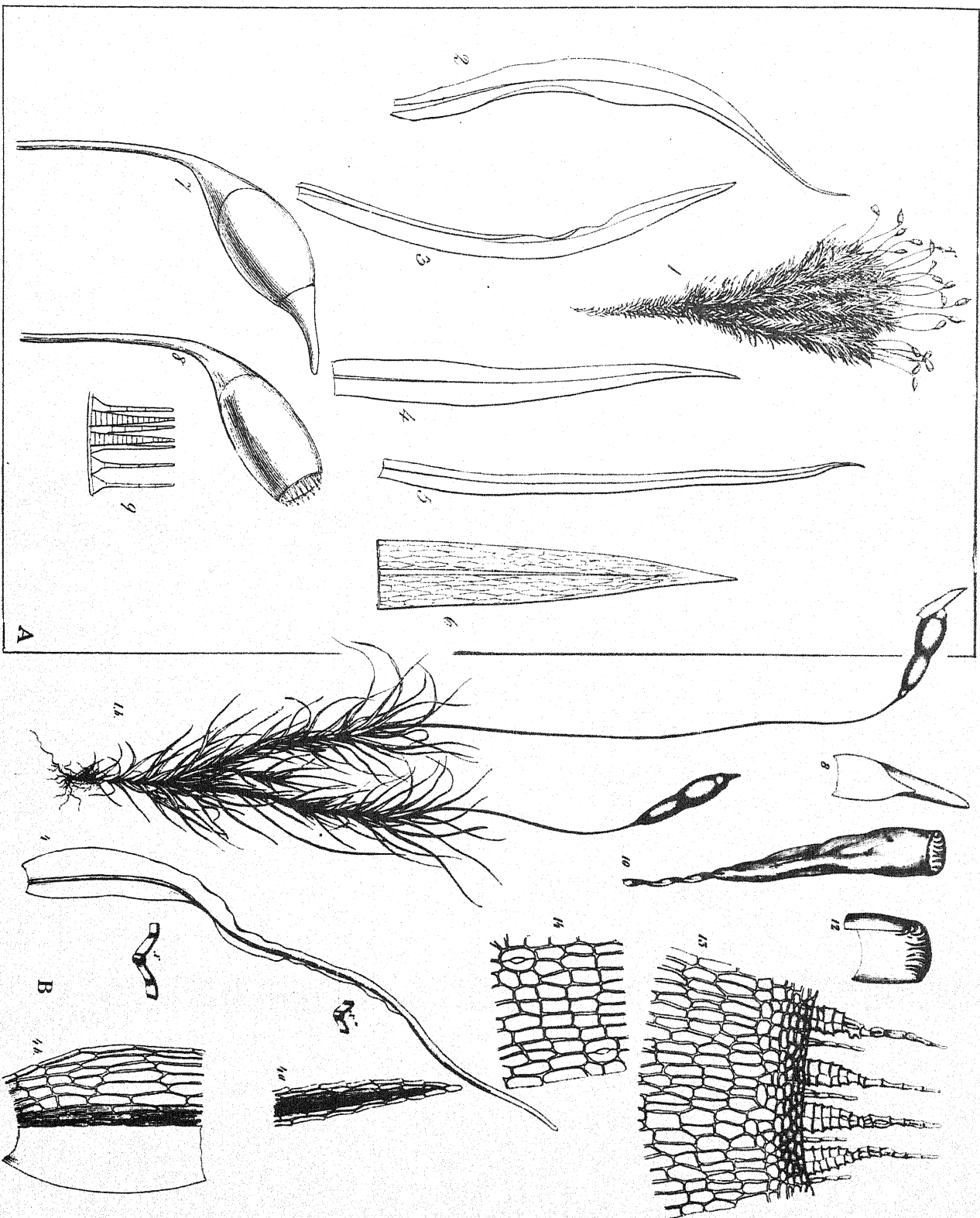


PLATE 72. A. *Orthodontium pellucens* (from Hooker, *Icones Plantarum* 1: *pl.* 34). 1, plants about $\times 10$; 2, 3, 4, 5, leaves; 6, leaf apex; 7, 8, capsules; 9, peristome.

B. *O. gracile* (from Bry. Eur. *pl.* 330). 1b, plant much enlarged; 4, leaf; 4a, 4b, cells of leaf at apex and base respectively; 8, calyptra; 10, dry capsule; 12, 13, mouth of capsule with peristome; 14, exothecial cells and stomata.

PLATE 73. A. *Pohlia defecta* (from The Bryologist 29: pl. 2). 1, fruiting plant $\times 6.5$; 2, same $\times 1.5$; 3, 4, longitudinal section of archegonial and antheridial plants respectively $\times 6.5$; 5, part of annulus; 6, two peristome teeth, dorsal view $\times 169$; 7, stem leaf $\times 45$; 8, perichaetial leaf $\times 45$; 9, tip of same $\times 169$; 10, basal leaf cells $\times 169$; 11, cross section of stem leaf $\times 169$.

B. *Pohlia Cardoti* (from Bull. Torr. Bot. Club. 27: pl. 21, as *P. porosa*). 1, capsules and opercula $\times 20$; 2, stoma $\times 292$; 3, exothecial cells $\times 292$; 4, part of peristome, external view $\times 208$; 5, internal view $\times 208$; 6, apex of tooth $\times 448$; 7, part of annulus $\times 208$; 8, 9, perigonal leaves $\times 64$; 10, cells of the same $\times 292$; 11, 12, perichaetial leaves $\times 28$; 13-15, lower leaves of a fertile stem; 16, upper leaves of a sterile stem $\times 64$; 17, leaf of a sterile stem $\times 64$; 18, apical cells of same $\times 448$; 19, median cells of the same $\times 448$; 20, basal cells $\times 448$; 21, cross section of base of the same $\times 448$; 22, apex of 12 $\times 292$; 23, median leaf cells of 12 $\times 448$; 24, cross section of base of perichaetial leaf $\times 88$; 25, same at base $\times 292$; 26-29, cross sections of leaves $\times 292$.

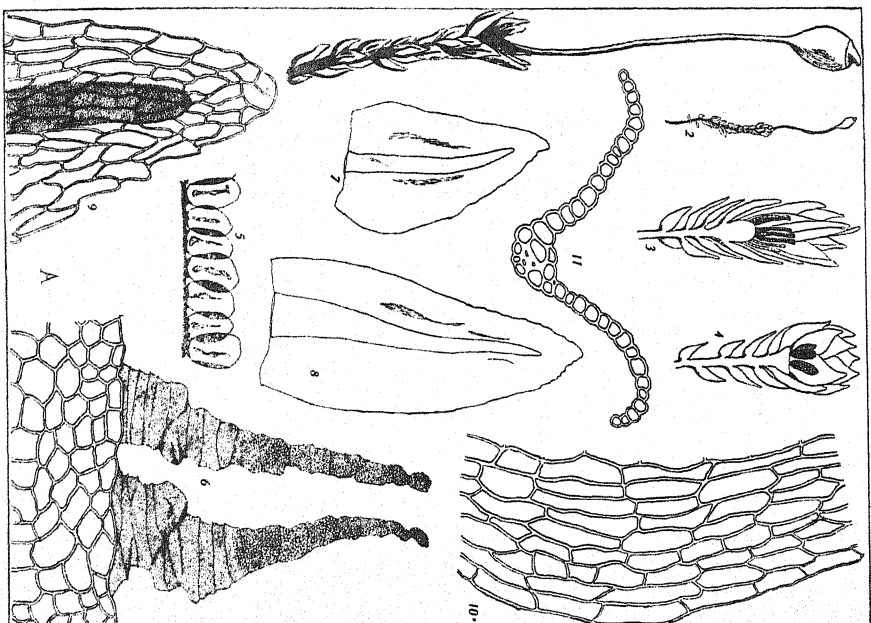
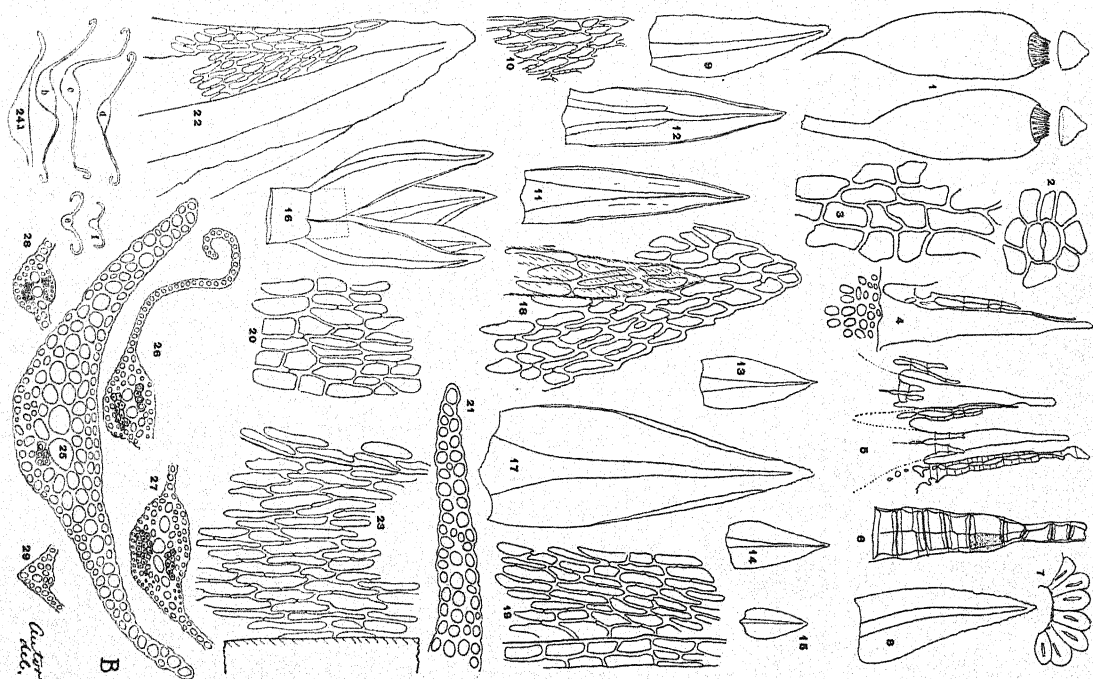


PLATE LXXIII.

POHLLIA POROSA



Carter
det.

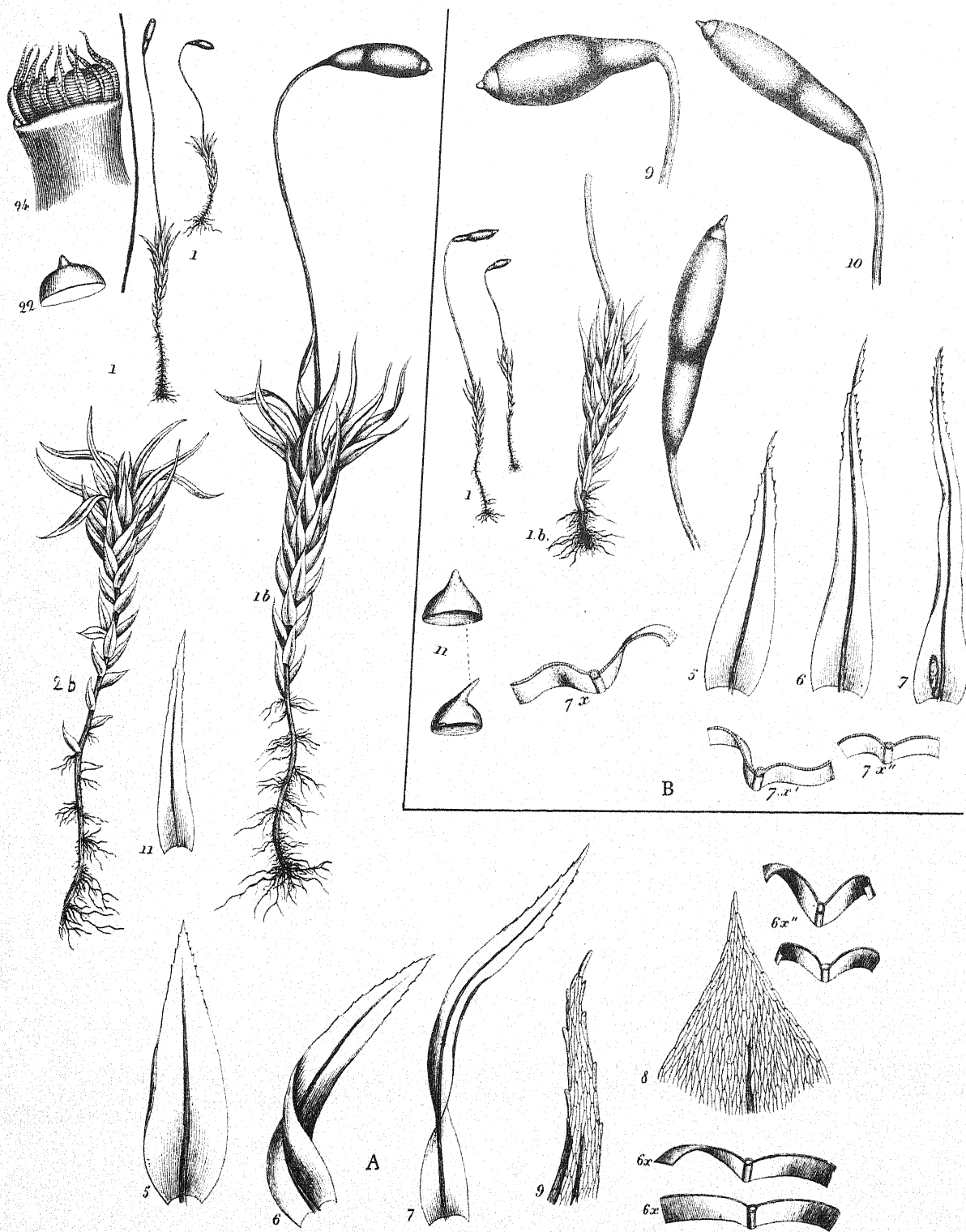


PLATE LXXIV.

PLATE 74. *A. Pohlia cruda* (from Bry. Eur. *pl.* 348). 1, plants $\times 1$; 1*b*, fertile plant; 2*b*, antheridial plant; 5, 6, 7, leaves from the lower to the upper; 6*x* etc., cross sections of leaf; 8, 9, areolation of leaf apices; 11, inner perichaetial leaf; 22, operculum; 24, mouth of capsule and peristome.

B. Pohlia longicolla (from Bry. Eur. *pl.* 346). 1, plants $\times 1$; 1*b*, enlarged; 5, 6, 7, leaves; 7*x* etc., cross sections of 7; 9, 10, capsules; 11, opercula.

PLATE 75. A. *Pohlia nutans* (from Bry. Eur. *pl.* 347). 2b, fertile plant much enlarged; 8, inflorescence; 9, perichaetial leaf; 10, portion of inner peristome; 17, annulus; 16, opercula.

B. *Pohlia acuminata* (from Bry. Eur. *pl.* 344, as *Bryum polymorphum*). 1, plants $\times 1$; 1b, plant enlarged; 5, 6, leaves; 5x, cross section of leaf; 7, cells of leaf apex; 12, portion of peristome; 14, annulus.

C. *Pohlia elongata* (from Bry. Eur. *pl.* 345). 1, plants $\times 1$; 3, enlarged; 9, 10, leaves; 9x, cross sections of leaf; 10a, 10b, areolation of leaf apex and base respectively; 14, capsules and operculum; 16, dry capsule; 17, annulus; 20, portion of inner peristome.

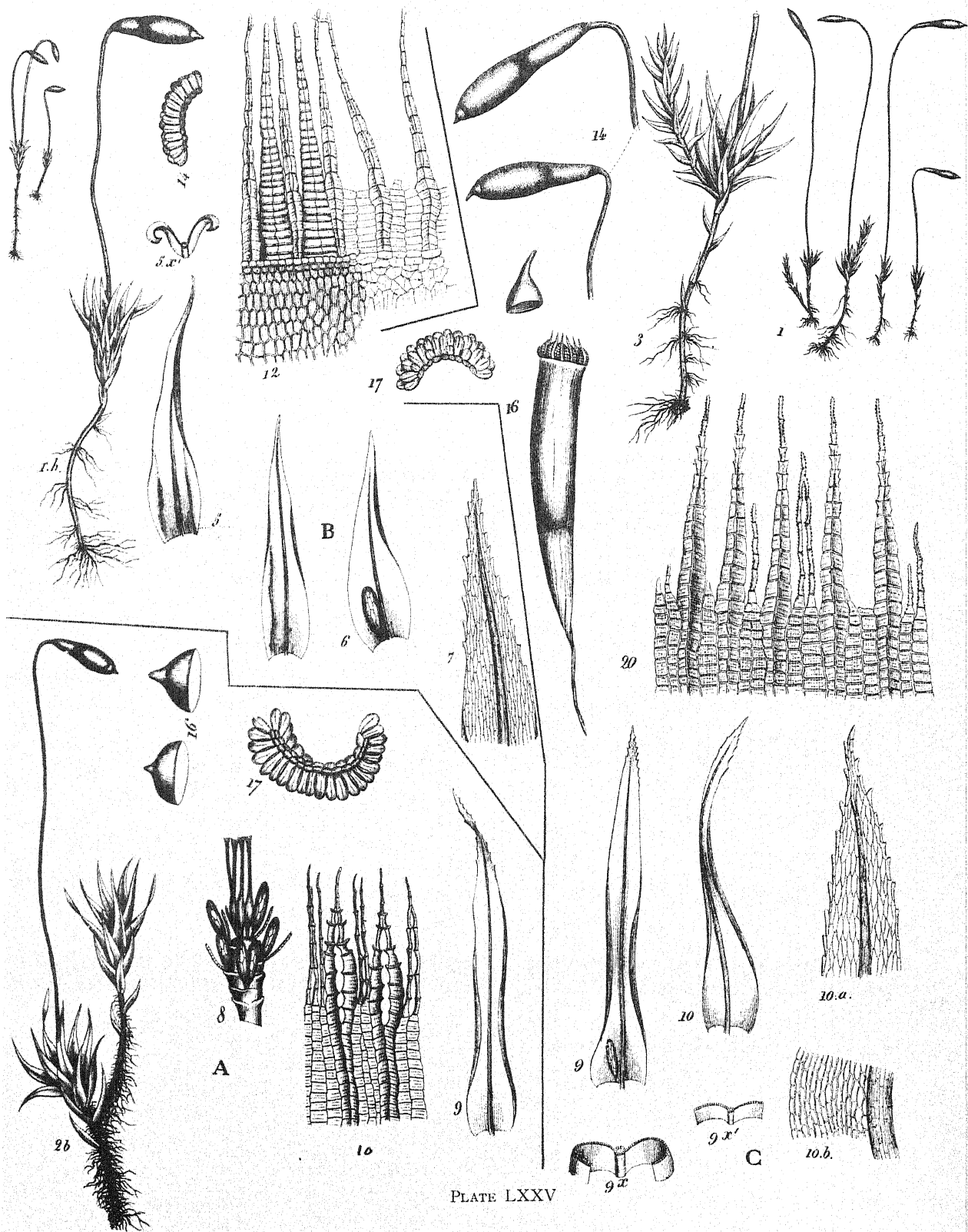
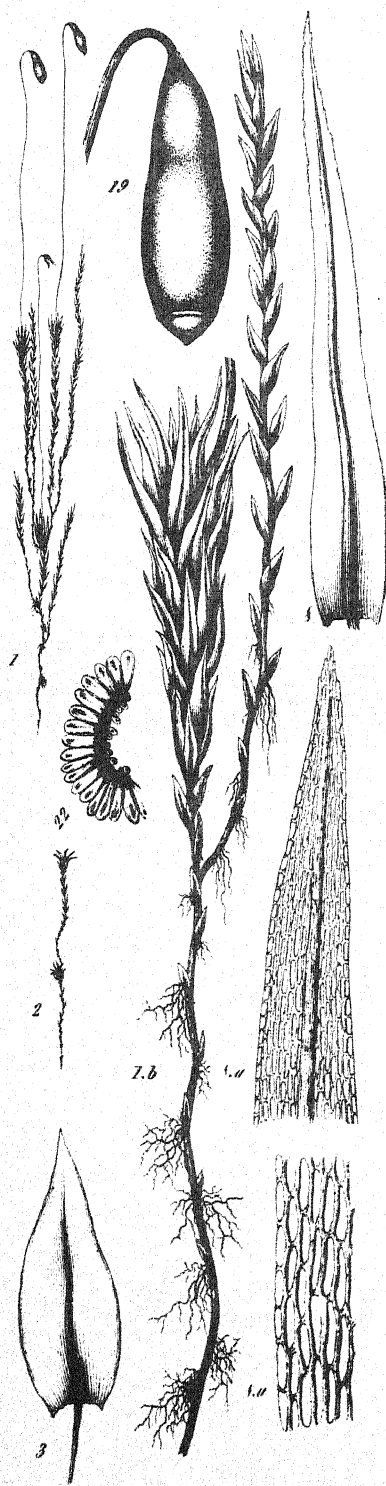
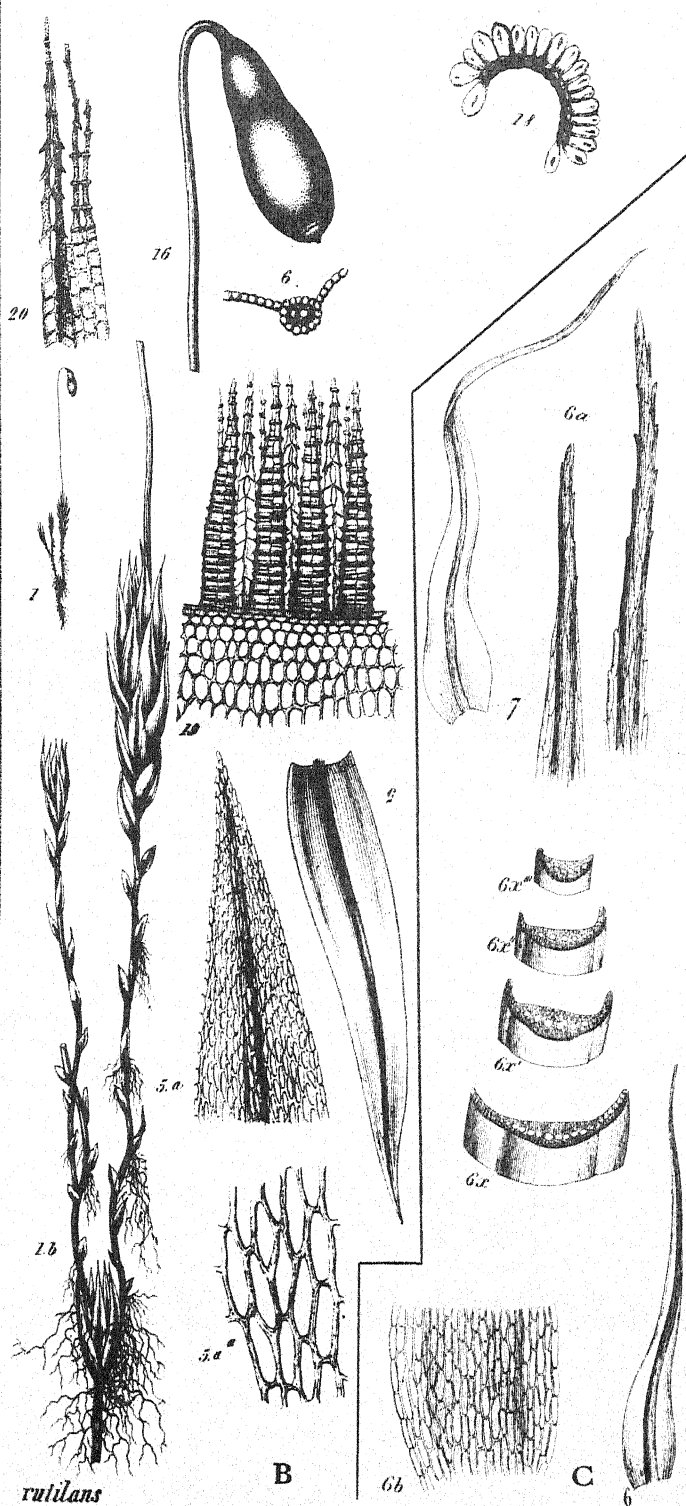


PLATE LXXV



spugnificola

A



rutilans

B

C

PLATE 76. A. *Pohlia sphagnicola* (from Bry. Eur. *pl.* 349). 1, plant \times 1; 1*b*, same plant much enlarged; 2, antheridial plant \times 1; 3, lower leaf; 8, upper leaf; 8*a*, areolation of apex and base of 8; 19, capsule; 22, annulus.

B. *Pohlia Schimperi* (from Bry. Eur. *pl.* 350, as *Bryum rutilans*). 1, plant \times 1; 1*b*, same enlarged; 5, leaf; 5*a*, apical cells of the same; 5*a*^a, leaf cells more enlarged; 6, cross section of costa; 16, capsule; 19, portion of peristome; 20, portion of inner peristome; 18, annulus.

C. *Leptobryum pyriforme* (from Bry. Eur. *pl.* 355). 6, 7, leaves; 6*x* etc., cross sections of leaf; 6*a*, leaf apices; 6*b*, leaf base showing wide costa.

PLATE 77. A. *Pohlia Ludwiggii* (from Pacific R. R. Reports 4: pl. 5, as *Bryum Bigelovii*). 3, fertile plant enlarged; 3', antheridial plant $\times 1$; 4, 5, leaves; 6, 7, areolation of leaf base and apex respectively; 17, cross section of leaf; 10, capsule; 11, operculum; 20, portion of peristome.

B. *Pohlia cucullata* (from Bry. Eur. pl. 343). 1, plant $\times 1$; 1b, same enlarged; 2, lower leaves; 4, upper leaves; 5, branch leaves; 4x, 4x', cross sections of leaf; 6, 7, leaf apices showing cells; 10, capsule; 11, peristome; 12, annulus.

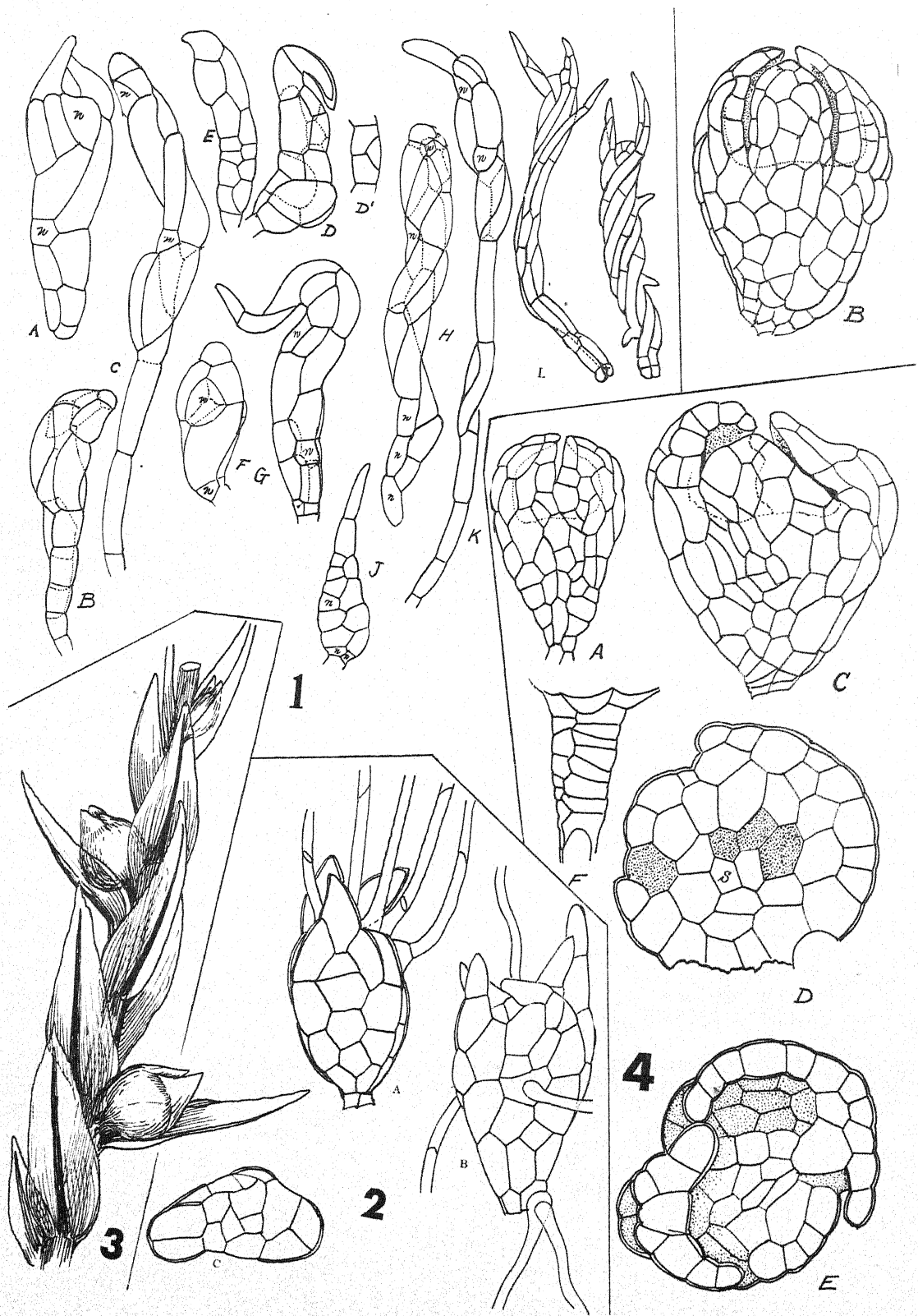


PLATE LXXVIII.

- PLATE 78. 1. *Pohlia prolifera* (from Correns, Untersuch. f. 101). A-K, various forms of brood bodies $\times 280$; L, *P. annotina decipiens* from The Bryologist 4: 62.
2. *Pohlia annotina* (Correns, l. c. f. 99). A, B, germinated brood bodies; B, sectional view, all $\times 280$.
3. *Pohlia Rothii* (Correns, l. c. f. 95). Portion of shoot with 2 brood bodies $\times 50$.
4. *Pohlia bulbifera* (Correns, l. c. f. 103). A, B, C, brood bodies $\times 210$; D, E, cross section of same $\times 290$, S is presumably the apical cell; F, stalk of a brood body.

PLATE 79. A. *Pohlia Tozeri* (from Bry. Eur. *pl.* 353). 1*b*, plant enlarged; 2*b*, antheridial plant enlarged; 5, leaves; 5*x*, cross section of leaf; 6, leaf apex showing areolation; 15, dry and empty capsule; 17, annulus; 18, portion of peristome.

B. *Pohlia vexans* (from Bry. Eur. *pl.* 352, as *Bryum pulchellum*). 1*b*, ♀ plant enlarged; 2*b*, ♂ plant enlarged; 5, 6, leaves; 5*x*, etc., cross sections of leaf; 7, leaf apex showing cells; 8, ♂ branch; 15, empty capsule; 18, portion of the inner peristome.

C. *Pohlia gracilis* (from Bry. Eur. *pl.* 351). β1*b*, plant enlarged; β6, leaves; β9, branch with gemmae; β10, gemmae.

D. *Pohlia carnea* (from Bry. Eur. *pl.* 353). 1, plants × 1; 1*b*, same enlarged; 2, ♂ plant × 1; 6, leaves; 5*x*, etc., cross sections of leaf; 7, cells of leaf apex; 8, median leaf cells; 15, dry and empty capsule; 17, portion of inner peristome.

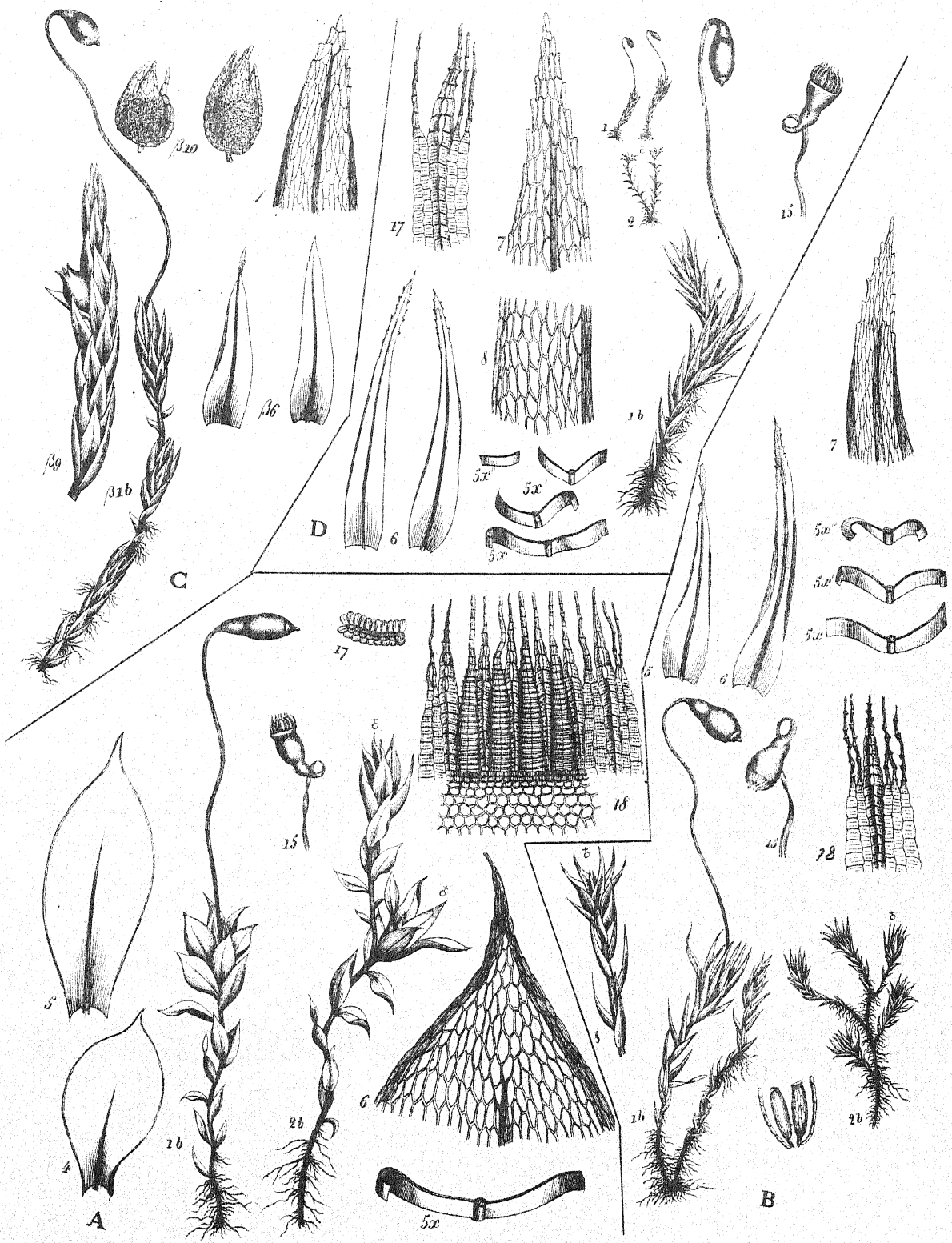


PLATE LXXIX.

PLATE 80. A. *Pohlia crudoides*. 1, plant $\times 2$; 2, leaves $\times 30$; 3, leaf apices $\times 150$; 4, median leaf cells $\times 300$; 5, cross section of leaf $\times 150$; 6, capsules $\times 20$; 7, portion of outer peristome $\times 150$; 8, complete peristome $\times 150$ (drawn by Seville Flowers).

*B. (from Acta Soc. pro Fauna et Flora Fennica 16: no. 5.). Figs. 1-15, *Pohlia atropurpurea*. 1-7, from a Norwegian plant collected by Wahlenberg. 1, 2, capsule dry and wet $\times 9$; 3, upper leaf $\times 30$; 4, lower leaf $\times 30$; 5, apical leaf cells $\times 100$; 6, external view of stoma $\times 300$.

8-12, from Drumm. Musc. Am. S. States 261. 8, stem leaf $\times 30$; 9, apical leaf cells $\times 100$; 10, 11, external and internal view of the same stoma $\times 300$; 12, external view of another stoma $\times 300$.

13-14, from a Lapland plant collected by Brotherus, external and internal view of a stoma. 15, external view of a stoma of a plant from the Yenisei.

16-25. *Pohlia columbica* (as *P. decurrens*). 16, 17, capsule dry and wet $\times 9$; 18, lower leaf $\times 30$; 19, 20, cells of leaf apex and leaf middle $\times 100$; 21, part of annulus adhering to edge of operculum, $\times 100$; 22, 23, stoma, external and internal view $\times 300$; 24, 25, median and upper exothecial cells $\times 135$.

*No. 5 was numbered 2 by a printer's error.

PLATE 81. A. *Pohlia longibracteata*. 1, ♀ plant $\times \frac{2}{3}$; 2 ♂ plant $\times \frac{2}{3}$; 3, upper leaves $\times 20$; 4, 5, stem leaves $\times 20$; 6, apical cells $\times 200$; 7, median basal cells $\times 200$; 8, median cells $\times 200$; 9, basal marginal cells $\times 200$; 10, lateral perigonium $\times 10$; 11, terminal perigonium $\times 10$; 12, perigonal leaves $\times 20$; 13, capsule $\times 14$; 14, peristome $\times 100$; 15, same, showing inner peristome straightened out $\times 100$; 16, tip of peristome tooth $\times 400$.

B. *Pohlia Crügeri*. 1, plant $\times 1$; 2, portion of plant $\times 3$; 3, 4, 5, leaves $\times 20$; 6, leaf apex $\times 100$.

C. *Brachymenium mexicanum*. 1, plant $\times 1$; 2, 2. leaves $\times 20$; 5, leaf apex $\times 200$; 6, basal marginal cells $\times 200$; 7, lower medial cells $\times 200$; 8, upper medial cells $\times 200$; 9, capsule $\times 13$; 10, peristome* $\times 100$. (All by Seville Flowers.)

* This is possibly an error as such a complete peristome is unusual.

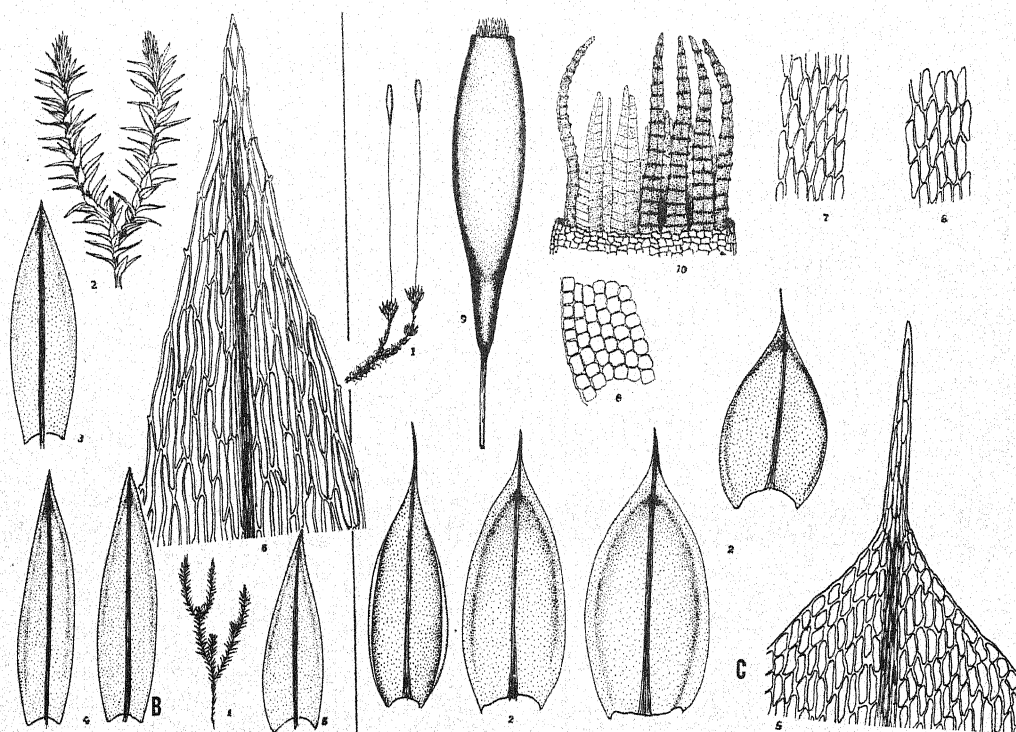
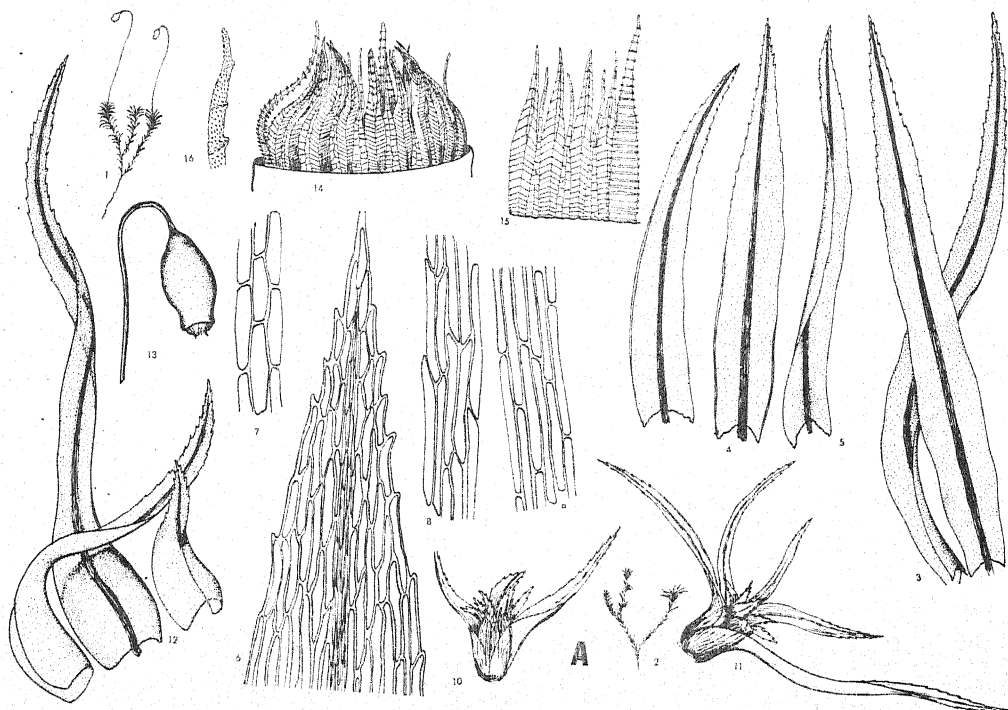


PLATE LXXXI.